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Energy Research Abstracts

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Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 18-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents.

Scope

The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

Availability

DOE and DOE contractors can obtain *ERA* (regular issues and annual indexes) by using VISA, MasterCard, or OSTI deposit accounts. Contact the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Leota S. Kane
Technical Editor, Barry C. Steele

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

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- Denmark
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- Italy
- Japan
- Norway
- Poland
- Republic of Korea
- Spain
- Sweden
- Switzerland
- The Netherlands
- United Kingdom
- United States

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The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
9. **Number of pages** or page range. Prices are based on total pages unless special pricing applies.
10. **Language** of document if non-English.
11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
12. **Sponsoring organization.**
13. **Contract or grant number.**
14. **Secondary identifying number;** may be a conference number.
15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in $30m^2$ air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Government Printing Office
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INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
Technology Administration
National Technical Information Service
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
Fax: (423) 576-2865
E-mail: reports@adonis.osti.gov

ESTSC Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831-1020

CASI Attention: Document Order
NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts.* Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–
T1 15:18494 NTIS, OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R2, *International Energy: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

Refer also to citation(s) 21336, 21385

0103 Preparation

Refer also to citation(s) 20557, 20562, 20572, 20588

20525 (CONF-941144–152) **Electrostatic beneficiation of coal.** Lindquist, D.A.; Mazumder, M.K.; Tennal, K.B.; McKendree, M.H.; Kleve, M.G.; Scruggs, S. Arkansas Univ., Little Rock, AR (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93203. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95010508. Source: OSTI; NTIS; GPO Dep.

Electrostatic beneficiation is being investigated as a dry precombustion cleaning method for removing pyritic forms of sulfur from coal. The coal is ground to a fine powder and then electrostatically charged. The pyrite particles adopt a negative charge and the carbon particles a positive charge. The pyrite and carbon fractions can then be separated in an electrostatic separator based on their charge differences. The efficiency of the beneficiation process is determined by quantitative sulfur analysis of the feed and processed coal. A description of the electrostatic beneficiation process and characterization of the physical and chemical properties of Illinois No. 6 bituminous coal processed by electrostatic beneficiation are presented.

20526 (DOE/PC/88881–T26-Vol.2) **Engineering development of advanced froth flotation. Volume 2, Final report.** Ferris, D.D. (ICF Kaiser Engineers, Inc., Pittsburgh, PA (United States)); Bencho, J.R.; Torak, E.R. ICF Kaiser Engineers, Inc., Pittsburgh, PA (United States); Ohio Coal Development Office, Columbus, OH (United States); Babcock and Wilcox Co., New Orleans, LA (United States); Consolidation Coal Co., Pittsburgh, PA (United States); Center for Research on Sulfur in Coal, Carterville, IL (United States); EIMCO Processed Equipment Co., Salt Lake City, UT (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). Geological Survey; Kentucky Energy Cabinet Lab., Lexington,Mar 1995. 499p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88881. Order Number DE95011486. Source: OSTI; NTIS; GPO Dep.

This report is an account of findings related to the Engineering and Development of Advanced Froth Flotation project. The results from benchscale and proof-of-concept (POC) level testing are presented and the important results from this testing are used to refine a conceptual design and cost estimate for a 20 TPH Semi-Works Facility incorporating the final proposed technology.

20527 (DOE/PC/88881–T27) **Engineering development of advanced physical fine coal cleaning technologies: Froth flotation. Quarterly technical progress report No. 25, October 1, 1994–December 31, 1994.** ICF Kaiser Engineers, Inc., Pittsburgh, PA (United States); Ohio Coal Development Office, Columbus, OH (United States); Babcock and Wilcox Co., New Orleans, LA (United States); Consolidation Coal Co., Pittsburgh, PA (United States); Center for Research on Sulfur in Coal, Carterville, IL (United States); EIMCO Processed Equipment Co., Salt Lake City, UT (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). Geological Survey; Kentucky Energy Cabinet Lab., Lexington,[1994]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88881. Order Number DE95014326. Source: OSTI; NTIS; GPO Dep.

A study conducted by Pittsburgh Energy Technology Center of sulfur emissions from about 1300 United States coal-fired utility boilers indicated that half of the emissions were the result of burning coals having greater than 1.2 pounds of SO_2 per million BTU. This was mainly attributed to the high pyritic sulfur content of the boiler fuel. A significant reduction in SO_2 emissions could be accomplished by removing the pyrite from the coals by advanced physical fine coal cleaning. An engineering development project was prepared to build upon the basic research effort conducted under a solicitation for research into Fine Coal Surface Control. The engineering development project is intended to use general plant design knowledge and conceptualize a plant to utilize advanced froth flotation technology to process coal and produce a product having maximum practical pyritic sulfur reduction consistent with maximum practical BTU recovery. This progress report provides a summary of the technical work undertaken during this period, highlighting the major results. A brief description of the work done prior to this quarter is provided in this report under the task headings.

20528 (DOE/PC/89908–T32) **Engineering design and analysis of advanced physical fine coal cleaning technologies. Final report.** Aspen Technology, Inc., Cambridge, MA (United States). Aug 1994. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89908. Order Number DE95010650. Source: OSTI; NTIS; GPO Dep.

This report describes the gravity separation equipment models available in the Coal Cleaning Simulator developed by Aspen Technology, Inc. This flowsheet simulator was developed in collaboration with ICF Kaiser Engineers, /a subcontractor to Aspen Technology, Inc., and CQ Inc., a subcontractor to ICF Kaiser Engineers. The algorithms and FORTRAN programs for modeling gravity separation, which include calculations for predicting process performance, and calculations for equipment sizing and costing, were developed by ICF Kaiser Engineers. Aspen Technology integrated these and other models into the ASPEN PLUS system to provide a simulator specifically tailored for modeling coal cleaning plants. ICF Kaiser Engineers also provided basic documentation for these models; Aspen Technology, Inc. has incorporated the information into this topical report. The report documents both the use and the design bases for the models, and provides to the user a good understanding of their range of applicability and limitations.

20529 (DOE/PC/92162–T5) **The development of coal-based technologies for Department of Defense facilities. Semiannual technical progress report, March 28, 1994–September 27, 1994.** Miller, B.G. (and others); Bartley, D.A.; Morrison, J.L. Consortium for Coal-Water Slurry Fuel Technology, University Park, PA (United States). 14 Apr 1995. 270p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract FC22-92PC92162. Order Number DE95012424. Source: OSTI; NTIS; GPO Dep.

The US Department of Defense (DOD), through an Interagency Agreement with the US Department of Energy (DOE), has initiated a three-phase program with the Consortium for Coal Water Slurry Fuel Technology, with the aim of decreasing DOD's reliance on imported oil by increasing its use of coal. The program is being conducted as a cooperative agreement between the Consortium and DOE and the first two phases of the program are underway. Activities this reporting period included performing coal beneficiation/preparation studies, conducting combustion performance evaluations, preparing retrofit engineering designs, determining retrofit economics, and installing a micronized coal-water mixture (MCWM) circuit.

20530 (DOE/PC/94155–T1) **POC-scale testing of an advanced equipment/technology. Quarterly technical progress report No. 1, October–December 1994.** Groppo, J.G.; Parekh, B.K. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. 30 Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-94PC94155. Order Number DE95010656. Source: OSTI; NTIS; GPO Dep.

The main objective of the proposed program is to evaluate a novel surface modification technique, which utilizes the synergistic effect of metal ions-surfactant combination, for dewatering of ultrafine clean coal on a proof-of-concept scale of 1 to 2 tph. The novel

surface modification technique developed at the University of Kentucky Center for Applied Energy Research (UKCAER) will be evaluated using vacuum, centrifuge, and hyperbaric filtration systems. Dewatering tests will be conducted using the fine clean coal froth produced by the column flotation units at the Powell Mountain Coal Company, Mayflower Preparation Plant in St. Charles, Virginia. The POC-scale studies will be conducted on two different types of clean coal, namely, high sulfur and low sulfur clean coal. The Mayflower Plant processes coals from five different seams, thus the dewatering studies results could be generalized for most of the bituminous coals. The project team met with the DOE project management representatives at the Pittsburgh Energy Technology Center on November 18, 1994 to review project plans. After review and comments provided by the DOE, the Project Management and Work Plans were issued on December 15, 1994. The project team held a meeting at the Powell Mountain Coal Company Mayflower Preparation Plant to discuss the strategy on installation and operation of the various dewatering units. Samples of the low sulfur and high sulfur clean coal froths were collected and shipped to UKCAER and Andritz Ruthner Inc.

20531 (WRI–95-R023) **The use of NMR techniques for the analysis of water in coal and the effect of different coal drying techniques on the structure and reactivity of coal. Final report.** Netzel, D.A.; Miknis, F.P.; Wallace, J.C. Jr.; Butcher, C.H.; Mitzel, J.M.; Turner, T.F.; Hurtubise, R.J. Western Research Inst., Laramie, WY (United States). Feb 1995. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91310. Order Number DE95015508. Source: OSTI; NTIS; GPO Dep.

Western Research Institute has conducted a study of different methods of coal drying as pretreatment steps before liquefaction. The objectives of this study were to develop a combined chemical dehydration/nuclear magnetic resonance (NMR) method for measuring the moisture content of coal, to measure the changes in coal structure that occur during drying, and to determine the effects of different drying methods on liquefaction reactivity of coals. Different methods of drying were investigated to determine whether coal drying can be accomplished without reducing the reactivity of coals toward liquefaction. Drying methods included thermal, microwave, and chemical dehydration. Coals of rank lignite to high volatile bituminous were studied. Coals that were dried or partially dried thermally and with microwaves had lower liquefaction conversions than coals containing equilibrium moisture contents. However, chemically dried coals had conversions equal to or greater than the premoisturized coals. The conversion behavior is consistent with changes in the physical structure and cross linking reactions because of drying. Thermal and microwave drying appear to cause a collapse in the pore structure, thus preventing donor solvents such as tetralin from contacting reactive sites inside the coals. Chemical dehydration does not appear to collapse the pore structure. These results are supported by the solvent swelling measurements in which the swelling ratios of thermally dried and microwave-dried coals were lower than those of premoisturized coals, indicating a greater degree of cross linking in the dried coals. The swelling ratios of the chemically dried coals were greater than those of the premoisturized coals because the pore structure remaining unchanged or increased when water was removed. These results are consistent with the NMR results, which did not show significant changes in coal chemical structure.

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Refer also to citation(s) 20531, 20573, 20591, 21105, 21155

20532 (CHEC-R–9306) **Pyrolysis and combustion of coke from Chalmers fluid bed.** Hansen, J.; Bank, L. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. Feb 1993. 24p. (In Danish). Order Number DE95787754. Source: OSTI; NTIS.

The aim was to investigate whether nitrous oxide was produced from coke and coal under various conditions of nitrogen monoxide, oxygen and carbon monoxide content in the gas phase. Most of the experiments were carried out at a temperature of 800 degrees centigrade, and some at temperatures of 750 and 950 degrees centigrade. The particulates were taken from a 12 MW(t) fluid bed boiler at Chalmers Tekniska Hoegskola (Sweden). A nitrous oxide analyzer produced by Perkin-Elmer was examined for efficiency. The experiments are described in detail. Under no conditions was there a deflection of more than 10 ppm N_2O particulates taken from the fluid bed, via gas chromatography an as yet unidentified component was found. Acetylene, used for welding, was found to contain an impurity to which the analyzer is sensitive. From the coke, particulates 'LEA KOKS' 220 ppm N_20 (F23) was measured at 800 degrees centigrade. In relation to F13 and F30, the gas analyzer measured 110 and 90 ppm. Via gas chromatography only large amounts of CH_4 were found. (AB)

20533 (DOE/MC/25006–3997) **Fluidized-bed testing of Z-SORB III sorbent.** Gupta, R. P.; Gangwal, S. K.; Khare, G. P. Research Triangle Inst., Research Triangle Park, NC (United States). Aug 1994. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25006. Order Number DE95000072. Source: OSTI; NTIS; GPO Dep.

Phillips Petroleum Company (PPCo) successfully developed a fluidizable version of their proprietary Z-SORB sorbent. Z-SORB sorbent is a ZnO-based regenerable sorbent for removing hydrogen sulfide (H_2S) and carbonyl sulfide (COS). RTI conducted a life-cycle test on this sorbent in the high-temperature, high-pressure (HTHP) semi-batch fluidized-bed reactor. This test consisted of 50 cycles of sulfidation and regeneration to demonstrate the long-term chemical reactivity and mechanical strength of the Z-SORB sorbent. A simulated air-blown gasifier coal gas was used at 20 atm and 538 °C (1,000°F). The Z-SORB sorbent exhibited excellent sulfur removal capability; the prebreakthrough H_2S levels were below the detection limit of the analyzer (<10 ppmv). The sulfur capacity of the sorbent at breakthrough (500 ppM H_2S in reactor exit gas) was 20.2 g S/100 g sorbent in Cycle 1 and was 10 g S/100 g sorbent in Cycle 50. The sorbent loss from the reactor due to fines generation was small. While no significant change in particle size was observed, the bulk density increased by 8 percent over 51 cycles. The attrition resistance of the sorbent after the 51 cycles was slightly lower than the fresh material. The thermogravimetric analyzer (TGA) tests on fresh and reacted sorbents confirmed the sulfur capacity decline in the bench tests; however, the TGA data indicated no change in the H_2S absorption rate between the fresh and reacted sorbents. The regeneration of the sulfided sorbent was successfully carried out using 2 to 2.5 percent 0_2 in N_2 at a temperature of 649 to 704°C (1,200 to 1,300°F) with no evidence of sulfate formation. Overall, the sorbent exhibited good performance.

20534 (DOE/MC/26042–4047) **PFBC HGCU Test facility. Technical progress report, Fourth quarter, CY 1994.** American Electric Power Service Corp., Columbus, OH (United States). Jan 1995. 311p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26042. Order Number DE95011302. Source: OSTI; NTIS; GPO Dep.

During this quarter, the Tidd Hot Gas Clean Up System completed a 691-hour test run which began during the third quarter. Table 1 summarizes all test runs since initial operation. Following this test run the system was shut down and the filter opened for inspection and recandling. The system remained out of service during the remainder of the quarter. In addition to monitoring and evaluating the performance of the HGCU system during testing, engineering effort was devoted to posttest inspection of the APF (Advanced Particle Filter) and evaluation of the effects of totally spoiling the primary cyclone. In addition, the authors worked with Westinghouse in the selection of replacement candles that were installed during the fourth quarter. During the unit outage this quarter, the primary cyclone upstream of the APF was modified to force all of the ash to pass through the cyclone and enter the APF without using spoiling air. Appendices to this report describe the dust shroud support strap design; an analysis of the effect of support-transferred vibrations on the failure of ceramic candle filters; the Tidd APF operation; the Tidd APF boroscope inspection; a general inspection of Tidd filter internals; tally of Tidd filters; ash formations in the W-APF-October 1994 post-test inspection; characterization of the as-manufactured and PFBC-exposed 3M CVI-SiC composite filter matrix; strength characterization of the first and second generation candle filters after 1,705 hours of PFBC operation at Tidd; and filters used in the December 1994 recandling effort at Tidd.

20535 (DOE/MC/28202–4041) **Conceptual design report – Gasification Product Improvement Facility (GPIF).** Sadowski, R.S. (CRS Sirrine Engineers, Inc., Greenville, SC (United States)); Skinner, W.H.; House, L.S.; Duck, R.R.; Lisauskas, R.A.; Dixit, V.J.; Morgan, M.E.; Johnson, S.A.; Boni, A.A. CRS Sirrine Engineers, Inc., Greenville, SC (United States); Riley Stoker Corp., Worcester, MA (United States); PSI Technology Co., Andover, MA (United States). PowerServe Div.; PSI-Environmental Instruments Corp., Andover, MA (United States). Sep 1994. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC28202. Order Number DE95011303. Source: OSTI; NTIS; GPO Dep.

The problems heretofore with coal gasification and IGCC concepts have been their high cost and historical poor performance of fixed-bed gasifiers, particularly on caking coals. The Gasification Product Improvement Facility (GPIF) project is being developed to solve these problems through the development of a novel coal gasification invention which incorporates pyrolysis (carbonization) with gasification (fixed-bed). It employs a pyrolyzer (carbonizer) to avoid sticky coal agglomeration caused in the conventional process of gradually heating coal through the 400 F to 900 F range. In so doing, the coal is rapidly heated sufficiently such that the coal tar exists in gaseous form rather than as a liquid. Gaseous tars are then thermally cracked prior to the completion of the gasification process. During the subsequent endothermic gasification reactions, volatilized alkali can become chemically bound to aluminosilicates in (or added to) the ash. To reduce NH_3 and HCN from fuel born nitrogen, steam injection is minimized, and residual nitrogen compounds are partially chemically reduced in the cracking stage in the upper gasifier region. Assuming testing confirms successful deployment of all these integrated processes, future IGCC applications will be much simplified, require significantly less mechanical components, and will likely achieve the $1,000/kWe commercialized system cost goal of the GPIF project. This report describes the process and its operation, design of the plant and equipment, site requirements, and the cost and schedule. 23 refs., 45 figs., 23 tabs.

20536 (DOE/MC/30056–4046) **Utilization of lightweight materials made from coal gasification slags. Quarterly report, December 1994–February 1995.** Praxis Engineers, Inc., Milpitas, CA (United States). Mar 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-94MC30056. Order Number DE95009702. Source: OSTI; NTIS; GPO Dep.

Integrated-gasification combined-cycle (IGCC) technology is an emerging technology that utilizes coal for power generation and production of chemical feedstocks. However, this process generates large amounts of solid waste, consisting of vitrified ash (slag) along with some unconverted carbon, which is disposed of as solid waste. The objectives of this project is to demonstrate the technical and economic viability of slag utilization technologies for commercial production of lightweight aggregates (LWA) and ultra-lightweight aggregates (ULWA) from slag and to test the suitability of these aggregates for various applications. The scheduled date for completing Phase I, which includes production of LWA and ULWA from slag at the large pilot-scale, is 14 December 1995. The scheduled start date for Phase II, which involves commercial utilization of these aggregates in a number of applications, is 15 December 1995, and the scheduled completion date of the project is 14 March 1997.

20537 (DOE/METC–95/1013) **MFIX documentation: User's manual.** Syamlal, M. EG and G Technical Services of West Virginia, Inc., Morgantown, WV (United States). Nov 1994. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-90MC26328. Order Number DE95012201. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020 (United States); GPO Dep.

MFIX (Multiphase Flow with Interphase exchanges) is a general-purpose hydro-dynamic model for describing chemical reactions and heat transfer in dense or dilute fluid-solids flows, which typically occur in energy conversion and chemical processing reactors. MFIX calculations give time-dependent information on pressure, temperature, composition, and velocity distributions in the reactors. The theoretical basis of the calculations is described in the MFIX Theory Guide. This report, which is the MFIX User's Manual, gives an overview of the numerical technique, and describes how to install the MFIX code and post-processing codes, set up data files and run MFIX, graphically analyze MFIX results, and retrieve data from the output files. Two tutorial problems that highlight various features of MFIX are also discussed.

20538 (DOE/PC/79818–T13) **Bench-scale co-processing economic assessment. Final report.** Gala, H.B.; Marker, T.L.; Miller, E.N. UOP, Inc., Des Plaines, IL (United States). Nov 1994. 269p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79818. Order Number DE95009312. Source: OSTI; NTIS; GPO Dep.

The UOP Co-Processing scheme is a single-stage slurry catalyzed process in which petroleum vacuum resid and coal are simultaneously upgraded to a high-quality synthetic oil. A highly active dispersed catalyst has been developed which enables the operation of the co-processing unit at relatively moderate and high temperatures and relatively high pressure. Under the current contract, a multi-year research program was undertaken to study the technical and economic feasibility of this technology. All the contractual tasks were completed. Autoclave experiments were carried out to evaluate dispersed vanadium catalysts, molybdenum catalysts, and a less costly UOP-proprietary catalyst preparation technique. Autoclave experiments were also carried out in support of the continuous pilot plant unit operation and to study the effects of the process variables (pressure, temperature, and metal loading on the catalyst). A total of 24 continuous pilot plant runs were made. Research and development efforts during the pilot plant operations were concentrated on addressing the cost effectiveness of the UOP single-stage slurry catalyzed co-processing concept based on UOP experience gained in the previous DOE contract. To this end, effect of catalyst metal concentration was studied and a highly-active Mo-based catalyst was developed. This catalyst enabled successful long-term operation (924 hours) of the continuous bench-scale plant at highly severe operating conditions of 3,000 psig, 465°C temperature, and 2:1 resid-to-MAF (moisture- and ash-free) coal ratio with 0. 1 wt % active metal. The metal loading of the catalyst was low enough to consider the catalyst as a disposable slurry catalyst. Also, liquid recycle was incorporated in the pilot plant design to increase the, reactor back mixing and to increase the flow of liquid through the reactor (to introduce turbulence in the reactor) and to represent the design of a commercial-scale reactor.

20539 (DOE/PC/88802–T9) **Exploratory coprocessing research. Quarterly report Number 9, September 1–November 30, 1990.** Hirschon, A.S.; Tse, D.T.; Malhotra, R.; McMillen, D.F.; Ross, D.S. SRI International, Menlo Park, CA (United States). May 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88802. Order Number DE95011908. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to: (1) study the scope of hydrothermal pretreatment of coal on subsequent conversion, (2) identify and study the chemical or physical causes of this effect, and (3) attempt to elucidate the chemistry responsible for any coal-resid synergisms. This project is divided into three tasks. This quarter the authors concentrated on Tasks 2 and 3 as described below. Task 2: chemistry of pretreatment. This Quarter they continued their investigation of the chemistry of pretreatment using an iron catalyst, (ferrous sulfate), both with and without aqueous pretreatment on Wyodak coal. The combination of iron and hydrothermal pretreatment gave the best results, as long as the pretreated coal was not dried prior to conversion. However, the combination of iron and pretreatment gave similar conversions as with pretreatment alone. Task 3: chemistry of synergy. To help provide a baseline for distinguishing between the benefits resulting from chemical and physical solvency factors, the authors decided to conduct some experiments in homogeneous systems, from which they can easily extract the impact due to chemical changes. They synthesized a series of benzyl aromatics and studied their cleavage in a mixture of anthracene and dihydroanthracene. Cleavage rates for the different substrates increase in the order diphenylmethane < benzylnaphthalene < benzylphenanthrene <

benzylpyrene. The log of observed first-order rate constants correlate linearly with the exothermicity of H-addition to the aromatic bearing the benzyl group, and are in excellent agreement with previously modeled results. The experimental results further show the generality of induced bond cleavage, and buttress the view of the possible chemical basis of improvements resulting from increased aromaticity.

20540 (DOE/PC/88802–T10) **Exploratory coprocessing research. Quarterly report Number 10, December 1, 1990–February 28, 1991.** Hirschon, A.S.; Tse, D.T.; Malhotra, R.; McMillen, D.F.; Ross, D.S. SRI International, Menlo Park, CA (United States). May 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88802. Order Number DE95011909. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to: (1) study the scope of hydrothermal pretreatment of coal on subsequent conversion, (2) identify and study the chemical or physical causes of this effect, and (3) attempt to elucidate the chemistry responsible for any coal-resid synergisms. This project is divided into three tasks. This quarter the authors concentrated on Tasks 1 and 2 as described below. Task 1: scope of hydrothermal pretreatment. The report contains a preprint submitted to the upcoming ACS meeting in Atlanta describing efforts to evaluate the aqueous pretreatment effect. The results showed that the aqueous pretreatment techniques at 350 C were most effective for the Wyodak coal, with the lignite showing a slight benefit, and the Illinois #6 coal showing essentially no benefit. Task 2: chemistry of pretreatment. This quarter the authors investigated the chemistry of pretreatment using labeled water. In particular, catechol that was treated with and without kaolin and $H_2{}^{18}O$ and was found to have labeled oxygen incorporation. They are aware of no precedents for such a reaction, and suspect that the exchange comes about from an intermediate step where the catechol dimerizes and can lose water in a reversible step. They further suspect that the role of kaolin for the polymerization reaction is to absorb or remove the water in some way so that the reaction is no longer reversible. However, the presence of water reverses the effect. Clays are well known to promote dehydration reactions, so such an explanation is reasonable.

20541 (DOE/PC/89881–T15) **Microbial recovery of metals from spent coal liquefaction catalysts. Final report.** Sperl, P.L.; Sperl, G.T. Geo-Microbial Technologies, Inc., Ochelata, OK (United States). [1995]. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89881. Order Number DE95014320. Source: OSTI; NTIS; GPO Dep.

This project was initiated on October 1, 1989, for the purpose of recovering metals from spent coal liquefaction catalysts. Two catalyst types were the subject of the contract. The first was a Ni-No catalyst support on alumina (Shell 324), the catalyst used in a pilot scale coal liquefaction facility at Wilsonville, Alabama. The second material was an unsupported ammonium molybdate catalyst used in a pilot process by the Department of Energy at the Pittsburgh Energy Technology Center. This material was obtained in late February 1990 but has not been pursued since the Mo content of this particular sample was too low for the current studies and the studies at the Pittsburgh Energy Technology Center have been discontinued. The object of the contract was to treat these spent catalysts with microorganisms, especially Thiobacillus ferrooxidans , but also other Thiobacillus spp. and possibly Sulfolobus and other potential microorganisms, to leach and remove the metals (Ni and Mo) from the spent catalysts into a form which could be readily recovered by conventional techniques.

20542 (DOE/PC/90027–T12) **Baseline design/economics for advanced Fischer-Tropsch technology. Quarterly report, July–September 1994.** Bechtel National, Inc., Richland, WA (United States); Amoco Research Center, Naperville, IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90027. Order Number DE95011379. Source: OSTI; NTIS; GPO Dep.

This report is Bechtel's twelfth quarterly technical progress report and covers the period of July through September, 1994. All major tasks associated with the contract study have essentially been completed. Effort is under way in preparing various topical reports for publication. The objectives of this study are to: Develop a baseline design and two alternative designs for indirect liquefaction using advanced F-T technology. The baseline design uses Illinois No. 6 Eastern Coal and conventional refining. There is an alternative refining case using ZSM-5 treatment of the vapor stream from the slurry F-T reactor and an alternative coal case using Western coal from the Powder River Basin. Prepare the capital and operating costs for the baseline design and the alternatives. Individual plant costs for the alternative cases win be prorated on capacity, wherever possible, from the baseline case. Develop a process flowsheet simulation (PFS) model; establish the baseline design and alternatives; evaluate baseline and alternative economics; develop engineering design criteria; develop a process flowsheet simulation (PFS) model; perform sensitivity studies using the PFS model; document the PFS model and develop a DOE training session on its use; and perform project management, technical coordination and other miscellaneous support functions. Tasks 1, 2, 3 and 5 have essentially been completed. Effort is under way in preparing topical reports for publication. During the current reporting period, work progressed on Tasks 4, 6 and 7. This report covers work done during this period and consists of four sections: Introduction and Summary; Task 4 - Process Flowsheet Simulation (PFS) Model and Conversion to ASPEN PLUS; Task 6 - Document the PFS model and develop a DOE training session on its use; and Project Management and Staffing Report.

20543 (DOE/PC/90045–T10) **Catalysts and process development for synthesis gas conversion to isobutylene. Quarterly report, July 1, 1991–September 30, 1991.** Anthony, R.G.; Akgerman, A. Texas A and M Univ., College Station, TX (United States). Research Foundation. 6 Nov 1991. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90045. Order Number DE95012296. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to develop a new catalyst, the kinetics for this catalyst, simulate the performance of fixed bed trickle flow reactors, slurry flow reactors, and fixed bed gas phase reactors for conversion of a hydrogen-lean synthesis gas to isobutylene. The goals for this year were to recruit and organize the project team, complete the literature and patent searches, complete the management plan and other reporting requirements, complete the revision and upgrading of existing bench scale units for the project, and synthesize, characterize and evaluate the catalytic activity of zirconia prepared (1) by co-precipitation of zirconyl nitrate with ammonium hydroxide and (2) by preparing a hydrous zirconium oxide using the modified sol gel method developed at the Sandia National Laboratories followed by calcination. The same preparation procedure would be used to prepare supports for impregnation with thorium nitrate, a potassium salt and a sodium salt. The synthesis of new crystalline zirconates were to be attempted with the objective of producing new compositions of matter which might have higher activities and selectivities than zirconia. Substantial progress on reactor and kinetic models for slurry and trickle bed reactors was to be achieved. Accomplishments for the year are described.

20544 (DOE/PC/90045–T11) **Catalyst and process development for synthesis gas conversion to isobutylene. Quarterly report, July 1, 1992–September 30, 1992.** Anthony, R.G.; Akgerman, A. Texas A and M Univ., College Station, TX (United States). Research Foundation. 13 Nov 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90045. Order Number DE95012903. Source: OSTI; NTIS; GPO Dep.

A series of zirconia catalysts prepared by a modified sol gel procedure, coprecipitation with ammonium hydroxide, and by a hydrothermal method were evaluated for catalytic activity. These catalysts were prepared containing silicon, thorium, titanium, cerium and the alkali metals. A catalyst containing 2% thorium on zirconia was the most active. The isobutylene and isobutane selectivity were 19.4 wt % and 1.82 wt %, respectively. Macro- and micro-kinetic models indicate that $C0_2$ formation inhibits the rate of CO conversion, hydrogen is dissociatively adsorbed, and CO is molecularly adsorbed. The microkinetic model indicates the strengthening of the metaloxygen bond might increase the production rate of isobutylene.

20545 (DOE/PC/90045–T12) **Catalyst and process development for synthesis gas conversion to isobutylene. Quarterly report, October 1, 1992–December 31, 1992.** Anthony, R.G.; Akgerman, A. Texas A and M Univ., College Station, TX (United States). Research Foundation. 1 Feb 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90045. Order Number DE95012904. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to develop a new catalyst, the kinetics for this catalyst, reactor models for trickle bed, slurry and fixed bed reactors, and simulate the performance of fixed bed trickle flow reactors, slurry flow reactors, and fixed bed gas phase reactors for conversion of a hydrogen lean synthesis gas to isobutylene. The goals for the quarter include: (1) Conduct experiments using a trickle bed reactor to determine the effect of reactor type on the product distribution. (2) Use spherical pellets of silica as a support for zirconia for the purpose of increasing surface, area and performance of the catalysts. (3) Conduct exploratory experiments to determine the effect of super critical drying of the catalyst on the catalyst surface area and performance. (4) Prepare a ceria/zirconia catalyst by the precipitation method.

20546 (DOE/PC/90045–T13) **Catalyst and process development for synthesis gas conversion to isobutylene. Quarterly report, January 1, 1993–March 31, 1993.** Anthony, R.G.; Akgerman, A. Texas A and M Univ., College Station, TX (United States). Research Foundation. 17 Apr 1993. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90045. Order Number DE95012905. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to develop a new catalyst, the kinetics for this catalyst, reactor models for trickle bed, slurry and fixed bed reactors, and simulate the performance of fixed bed trickle flow reactors, slurry flow reactors, and fixed bed gas phase reactors for conversion of a hydrogen lean synthesis gas to isobutylene. The six main accomplishments for the quarter are the following: (1) activity testing with the 7% (wt) Ce-ZrO_2, (2) activity testing the same catalyst with CO from an aluminum cylinder, (3) preparation of ZrO_2 by heating zirconyl nitrate, (4) preparation of an active zirconia prepared by a modified sol gel procedure and evaluation of the catalytic activity of a commercial zirconia and the catalysts prepared by the sol gel procedure, (5) determining the effect of separator temperatures and oil flow rate on the performance of a trickle bed reactor, and (6) calculation of the equilibrium composition of the C_2 to C_5 olefins, and initiation of the development of a macrokinetic model. The details of each of these accomplishments are discussed.

20547 (DOE/PC/90045–T14) **Catalyst and process development for synthesis gas conversion to isobutylene. Final report, September 1, 1990–January 31, 1994.** Anthony, R.G.; Akgerman, A. Texas A and M Univ., College Station, TX (United States). Research Foundation. 6 May 1994. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90045. Order Number DE95012906. Source: OSTI; NTIS; GPO Dep.

Previous work on isosynthesis (conversion of synthesis gas to isobutane and isobutylene) was performed at very low conversions or extreme process conditions. The objectives of this research were (1) determine the optimum process conditions for isosynthesis; (2) determine the optimum catalyst preparation method and catalyst composition/properties for isosynthesis; (3) determine the kinetics for the best catalyst; (4) develop reactor models for trickle bed, slurry, and fixed bed reactors; and (5) simulate the performance of fixed bed trickle flow reactors, slurry flow reactors, and fixed bed gas phase reactors for isosynthesis. More improvement in catalyst activity and selectivity is needed before isosynthesis can become a commercially feasible (stand-alone) process. Catalysts prepared by the precipitation method show the most promise for future development as compared with those prepared hydrothermally, by calcining zirconyl nitrate, or by a modified sol-gel method. For current catalysts the high temperatures (>673 K) required for activity also cause the production of methane (because of thermodynamics). A catalyst with higher activity at lower temperatures would magnify the unique selectivity of zirconia for isobutylene. Perhaps with a more active catalyst and acidification, oxygenate production could be limited at lower temperatures. Pressures above 50 atm cause an undesirable shift in product distribution toward heavier hydrocarbons. A model was developed that can predict carbon monoxide conversion an product distribution. The rate equation for carbon monoxide conversion contains only a rate constant and an adsorption equilibrium constant. The product distribution was predicted using a simple ratio of the rate of CO conversion. This report is divided into Introduction, Experimental, and Results and Discussion sections.

20548 (DOE/PC/90054–T6) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, January 1992–March 1992.** Osseo-Asare, K.; Boakye, E.; Radovic, L.R. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. May 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014742. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size will be carried out. It is based on the molecular design of reverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis will be on iron- and molybdenum-based catalysts, but the techniques to be developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal or char matrix will be characterized using the following techniques: dynamic light scattering, x-ray diffraction, x-ray photoelectron spectroscopy, scanning and/or transmission electron microscopy, and selective chemisorption. Catalytic activity tests will be conducted under standardized conditions in both hydrogenation and hydrodesulfurization reactions. The effect of particle size of these unsupported catalysts on the product yield and distribution during liquefaction of a bituminous and a subbituminous coal will thus be quantitatively determined.

20549 (DOE/PC/90054–T7) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, April 1992–June 1992.** Osseo-Asare, K.; Boakye, E.; Radovic, L.R. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014743. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size will be carried out. It is based on the molecular design of reverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis will be on iron- and molybdenum-based catalysts, but the techniques to be developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal or char matrix will be characterized using the following techniques: dynamic light scattering, x-ray diffraction, x-ray photoelectron spectroscopy, scanning and/or transmission electron microscopy, and selective chemisorption. Catalytic activity tests will be conducted under standardized conditions in both hydrogenation and hydrodesulfurization reactions. The effect of particle size of these unsupported catalysts on the product yield and distribution during liquefaction of a bituminous and a subbituminous coal will thus be quantitatively determined.This quarter, the effect of ammonium tetrathiomolybdate concentration on the synthesis of molybdenum sulfide in the 0.15 M NP-5/cyclohexane/water microemulsion system is discussed.

20550 (DOE/PC/90054–T8) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, July 1992–September 1992.** Boakye, E. (and others); Vittal, M.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Oct 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014744. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size will be carried out. It is based on the molecular design of reverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle. nucleation, growth and agglomeration. The emphasis will be on iron- and molybdenum-based catalysts, but the techniques to be developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal or char matrix will be characterized using the following techniques: dynamic light scattering, x-ray diffraction, x-ray photoelectron spectroscopy, scanning and/or transmission electron microscopy, and selective chemisorption. Catalytic activity tests will be conducted under standardized conditions in both hydrogenation and hydrodesulfurization reactions. The effect of particle size of these unsupported catalysts on the product yield and distribution during liquefaction of a bituminous and a subbituminous coal will thus be quantitatively determined.

20551 (DOE/PC/90054–T9) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, October 1992–December 1992.** Boakye, E. (and others); Vittal, M.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Feb 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014745. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size is being carried out. It is based on the molecular design of reverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis is on molybdenum- and iron-based catalysts, but the techniques being developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal or char matrix are characterized using a battery of techniques, including dynamic light scattering, x-ray diffraction and transmission electron microscopy. Catalytic activity tests are conducted under standardized coal liquefaction conditions. The effect of particle size of these unsupported catalysts on the product yield and distribution during conversion of a bituminous and a subbituminous coal are being determined.In this quarter, the synthesis of molybdenum sulfide in a microemulsion system with an alcohol-to-surfactant mass ratio of 3.5 is reported.

20552 (DOE/PC/90054–T10) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, January 1993–March 1993.** Boakye, E. (and others); Vittal, M.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Apr 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014746. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size is being carried out. It is based on the molecular design of reverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis is on molybdenum- and iron-based catalysts, but the techniques being developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal or char matrix are characterized using a battery of techniques, including dynamic light scattering, x-ray diffraction and transmission electron microscopy. Catalytic activity tests are conducted under standardized coal liquefaction conditions. The effect of particle size of these unsupported catalysts on the product yield and distribution during conversion of a bituminous and a subbituminous coal are being determined. This quarter, the solubilization of ammonium tetrathiomolybdate and the synthesis of molybdenum sulfide in several microemulsion systems is discussed.

20553 (DOE/PC/90054–T11) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, April 1993–June 1993.** Boakye, E. (and others); Vittal, M.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Jul 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014747. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size is being carried out. It is based on the molecular design of inverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis is on molybdenum- and iron-based catalysts, but the techniques being developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal matrix are characterized using a battery of techniques, including g dynamic light scattering, x-ray diffraction and transmission electron microscopy. Catalytic activity tests are conducted under standardized coal liquefaction conditions. The effects of particle size of these unsupported catalysts on the product yield and distribution during conversion of a bituminous and a subbituminous coal are being determined. This report discusses molybdenum sulfide particle synthesis, characterization, and microemulsion characterization.

20554 (DOE/PC/90054–T12) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, July–September 1993.** Boakye, E. (and others); Vittal, M.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Oct 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014748. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to pursue the development of highly dispersed and inexpensive catalysts for improved coal solubilization and upgrading of coal liquids. A novel study of the synthesis of liquefaction catalysts of manometer size is being carried out. It is based on the molecular design of inverse micelles (microemulsions). These surfactant-stabilized, metal-bearing microdrops offer unique opportunities for synthesizing very small particles by providing a cage-like effect that limits particle nucleation, growth and agglomeration. The emphasis is on molybdenum- and iron-based catalysts, but the techniques being developed should also be generally applicable. The size of these very small and monodispersed particles will be accurately determined both separately and

after in situ and ex situ coal impregnation. The as-prepared nanoparticles as well as the catalyst-impregnated coal matrix are characterized using a battery of techniques, including dynamic light scattering, x-ray diffraction and transmission electron microscopy. Catalytic activity tests are conducted under standardized coal liquefaction conditions. The effects of particle size of these unsupported catalysts on the product yield and distribution during conversion of a bituminous and a subbituminous coal are being determined.

20555 (DOE/PC/90293–T15) **High-temperature membranes for H_2S and SO_2 separations. Final report.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). Jan 1995. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90293. Order Number DE95009310. Source: OSTI; NTIS; GPO Dep.

Electrochemical cells which separate H_2S and $S0_2$ from hot gas streams have two important materials issues that limit their successful industrial application: (1) membranes and (2) electrodes. These were the focus of the present study. For the H_2S work, experimental analysis incorporated several membrane and electrode materials; densified zirconia provided the best matrices for entrainment of electrolytic species, ionic mobility, and a process-gas barricade hindering the capabilities of gas cross-over, alternate reactions. Electrode materials of lithiated Ni converted to NiO in-situ were successful in polishing applications; however H_2S levels >100 ppM converted the NiO cathode to a molten nickel sulfide necessitating the use of Co. Lithiated NiO for the anode material remained morphologically stable and conductive in all experimentation. High temperature electrochemical removal of H_2S from coal gasification streams has been shown on the bench scale level at the Georgia Institute of Technology utilizing the aforementioned materials. Experimental removals from 1000 ppM to 100 ppM H_2S and 100 ppM to 10 ppM H_2S proved over 90% removal with applied current was economically feasible due to high current efficiencies (~100%) and low polarizations. For the $S0_2$work, an extensive search was conducted for a suitable membrane material for use in the $S0_2$ removal system. The most favorable material found was Si_3N_4, proven to be more efficient than other possible materials. New lithiated NiO electrodes were also developed and characterized, proving more stable than previously used pervoskite electrodes. The combination of these new components led to 90% removal at near 100% current efficiency over a wide range of current densities.

20556 (DOE/PC/91051–T8-Vol.1) **Advanced liquefaction using coal swelling and catalyst dispersion techniques. Volume 1, Final technical report, October 1, 1991–September 30, 1994.** Curtis, C.W. (Auburn Univ., (United States)); Gutterman, C.; Chander, S. Amoco Oil Co., Naperville, IL (United States). Research and Development Dept. [1994]. 364p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91051. Order Number DE95009446. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project was to develop a new approach for the direct liquefaction of coal to produce an all-distillate product slate at a sizable cost reduction over current technology. The approach integrated coal selection, pretreatment, coal swelling with catalyst impregnation, liquefaction, product recovery with characterization, alternate bottoms processing, and a technical assessment including an economic evaluation. Heterofunctional solvents were the most effective in swelling coals. Also solvent blends such as isopropanol/water were more effective than pure solvents alone. Impregnating slurry catalysts simultaneously during coal swelling showed that better uptake was achieved with nonswelling solvent and higher impregnation temperature. Some enhancement in initial coal conversion was seen liquefying SO_2-treated Black Thunder coal with slurry catalysts, and also when hydrogen donor liquefaction solvents were used. Noncatalytic reactions showed no benefit from SO_2 treatment. Coupling coal swelling and SO_2 treatment with slurry catalysts was also not beneficial, although high conversion was seen with continuous operation and long residence time, however, similar high conversion was observed with untreated coal. SO_2 treatment is not economically attractive unless it provides about 17% increase in coal reactivity. In most cases, the best results were obtained when the coal was untreated and the slurry catalyst was added directly into the reactor. Foster Wheeler's ASCOT process had better average liquid yields than either Wilsonville's vacuum tower/ROSE combination or delayed coking process. This liquid product also had good quality.

20557 (DOE/PC/91051–T9) **Advanced liquefaction using coal swelling and catalyst dispersion techniques. Quarterly progress report, July–September 1993.** Curtis, C.W. (Auburn Univ., (United States)); Gutterman, C.; Chander, S. Amoco Oil Co., Naperville, IL (United States). Research and Development Dept. [1993]. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91051. Order Number DE95011907. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a new approach for the direct liquefaction of coal to produce an all-distillate product slate at a sizable cost reduction over current technology. The approach integrates coal selection, pretreatment, coal swelling with catalyst impregnation, liquefaction, product recovery with characterization, alternate bottoms processing, and carrying out a technical assessment including an economic evaluation. The primary coal of this program, Black Thunder subbituminous coal, can be effectively beneficiated to about 3.5 wt% ash using aqueous sulfurous acid pretreatment. This treated coal can be further beneficiated to about 2 wt% ash using commercially available procedures. All three coals used in this study (Black Thunder, Burning Star bituminous, and Martin Lake lignite) are effectively swelled by a number of solvents. The most effective solvents are those having hetero-functionality. laboratory- and bench-scale liquefaction experimentation is underway using swelled and catalyst impregnated coal samples. Higher coal conversions were observed for the SO_2-treated subbituminous coal than the raw coal, regardless of catalyst type. Conversions of swelled coal were highest when Molyvan L, molybdenum naphthenate, and nickel octoate, respectively, were added to the liquefaction solvent. The study of bottoms processing consists of combining the ASCOT process which consists of coupling solvent deasphalting with delayed coking to maximize the production of coal-derived liquids while rejecting solids within the coke drum. The asphalt production phase has been completed; representative product has been evaluated. The solvent system for the deasphalting process has been established. Two ASCOT tests produced overall liquid yields (63.3 wt% and 61.5 wt%) that exceeded the combined liquid yields from the vacuum tower and ROSE process.

20558 (DOE/PC/91055–T11) **Role of the resid solvent in catalytic coprocessing with finely divided catalysts. Quarterly report, January–March 1995.** Curtis, C.W. Auburn Univ., AL (United States). Dept. of Chemical Engineering. [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91055. Order Number DE95014329. Source: OSTI; NTIS; GPO Dep.

The research reported in this progress report describes the continuation of coal-resid coprocessing reactions that were discussed in the July to September 1994 Quarterly Report. During previous quarters, Maya and FHC-623 resids were evaluated in noncatalytic and catalytic reactions at 400°C with Pittsburgh No. 8 and DECS-17 Blind Canyon coals. From the complete reaction matrix containing the two coals and two resids, it was found that the influence of resids on coprocessing depended on the type of coal used; for example, under catalytic reaction conditions, the hexane solubles of Maya resid increased coal conversion of Pittsburgh No. 8 coal but decreased that of DECS-17. In order to observe the intrinsic behavior of resids during coprocessing, another resid, Manji, and another coal, Illinois No. 6, are being tested. These reactions were begun this quarter. The results obtained are reported in this report.

20559 (DOE/PC/91311–T14) **Configurational diffusion of asphaltenes in fresh and aged catalyst extrudates. Quarterly progress report, December 20, 1994–March 20, 1995.** Guin, J.A. Auburn Univ., AL (United States). Dept. of Chemical Engineering. [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91311. Order Number DE95015613. Source: OSTI; NTIS; GPO Dep.

This quarter, GPC column efficiency and resolution were tested. Better resolution and separation of petroleum asphaltenes were obtained in GPC by connecting four columns (1000Å, 1000Å, 500Å, 500Å pore sizes, respectively) in series. A good linear column calibration curve was obtained using several polystyrene standards

with molecular weights ranging from 500 to 5 x 10^4. The molecular weight distribution of a petroleum asphaltenes was approximated by the polystyrene calibration curve.

20560 (DOE/PC/92149–T9) **Deashing of coal liquids with ceramic membrane microfiltration and diafiltration. Final quarterly technical progress report, October 1–December 31, 1994.** CeraMem Corp., Waltham, MA (United States). [1994]. 801p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92149. Order Number DE95015612. Source: OSTI; NTIS; GPO Dep.

Diafiltration experiments were done to determine how much particulate- free oil could be extracted from the solids-containing stream. The 0. 05 μm titania membrane was used for the concentration/diafiltration process runs at 270 C, 80 psig inlet pressure, and 6 gpm crossflow. Five concentration process runs were conducted. After the initial run, the concentrated material was diluted with hydrotreated start-up oil from the final solids back to 10% solids. The concentration was limited by increased pressure drop with increased solids content and plugged membrane module channels. Solids retention was greater than 99.5% for all samples. Attempts to clean membranes with solvent failed due to lack of time. Samples of the permeate and concentrate streams were taken for analysis; the diluent had a similar bp range to the coal liquids in the atmospheric bottoms; thus, distillation could not be used to separate the bottoms from the diluent.

20561 (DOE/PC/93218–6) **Photochemical coal dissolution. Quarterly technical progress report, January 1–March 31, 1995.** Doetschman, D.C. State Univ. of New York, Binghamton, NY (United States). Dept. of Chemistry. 23 Mar 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93218. Order Number DE95012429. Source: OSTI; NTIS; GPO Dep.

Progress on the performance of the coal photochemical extractions this quarter has fallen behind schedule. Work on the project scheduled for other times has been pursued instead. At the beginning of the quarter, the sealing off of an undesirable solvent flow pathway in the Ace Glass photochemical reactor was unsuccessful. Due either to pre-existing strains in the glass or to poor procedure, the reactor was damaged beyond repair and a new system was ordered immediately. Shortly after experiments began with the new system, a port of the new Ace Glass reactor equipped with a screwed-down tightened O-ring seal snapped off, a situation clearly due to a poorly annealed glass join. The reactor is presently still under return for repair. The graduate student on the project has put his energies into other project-related work. One type of work was to prepare the extracts that will be needed in future coal photoextractions. The third type of alternate activity on which the P.I. and graduate student have been working is literature work and discussion of the project. These have focused on the probable mechanisms of (1) the direct coal irradiation photolysis, (2) the extract-sensitized coal photolysis, and (3) solvent-sensitized coal photolysis. Considerations have revolved around how free radicals generated from photoexcited coal, coal extract or solvent species cause coal breakdown. How these radicals may perform some of the functions of free radicals in thermal, catalytic coal hydrogenation liquefaction is becoming clearer.

20562 (DOE/PC/94206–T2) **Supercritical fluid reactions for coal processing. Quarterly progress report, January 1, 1995–March 31, 1995.** Eckert, C.A. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94206. Order Number DE95015614. Source: OSTI; NTIS; GPO Dep.

Exciting opportunities exist for the application of supercritical fluid (SCF) reactions for the pre-treatment of coal. Utilizing reactants which closely resemble the organic sulfur and nitrogen containing components of coal, we propose to develop a method to tailor chemical reactions in supercritical fluid solvents for the specific application of coal desulfurization and denitrogenation. Diels-Alder reactions involving such compounds have been extensively studied and characterized in liquids. However, there is very little understanding of such reactions in SCF'S. We are developing an approach which will allow optimum design of coal desulfurization and denitrogenation processes.

20563 (DOE/PC/94209–T2) **Regulation of coal polymer degradation by fungi, Second quarterly report, [October–December 1994].** Bumpus, J.A. (University of Northern Iowa, Cedar Falls, IA (United States). Dept. of Chemistry). Notre Dame Univ., IN (United States). 26 Jan 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94209. Order Number DE95012252. Source: OSTI; NTIS; GPO Dep.

Since our last quarterly report our research activities have focused on characterization of coal macromolecule by P. chrysosporium in vivo in ;two different culture media and by sodium oxalate in vitro. Wood rotting fungi mediate solubilization of low rank coal by secreting oxalic acid which chelates metal ions whose chelating metal ions oxalic acid breaks these ionic bridges rendering the coal macromolecules water soluble. Thus solubization by sodium oxalate in vitro represents a biomimetic process.

20564 (DOE/PC/94219–T2) **Separation of Fischer-Tropsch wax from catalyst by supercritical fluid extraction. Technical progress report, January–March 1995.** Thies, M.C. Clemson Univ., SC (United States). Dept. of Chemical Engineering. [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94219. Order Number DE95015610. Source: OSTI; NTIS; GPO Dep.

Objective is to evaluate the potential of supercritical fluid extraction for separating the catalyst slurry of a Fischer-Tropsch (F- T) slurry bubble column reactor into a wax and a concentrated catalyst slurry that is ready for recycle/regeneration. The automated apparatus was evaluated using a toluene-petroleum pitch system. The Statistical Associating Fluid Theory (SAFT) equation will be used to fit the VLE and LLE data for F-T wax-solvent systems; this equation was successful in predicting both phase compositions and average molecular weight distributions.

20565 (LBL–37027) **Fundamental studies of the mechanism of catalytic reactions with catalysts effective in the gasification of carbon solids and the oxidative coupling of methane. Quarterly report, July 1, 1994–September 30, 1994.** Iglesia, E.; Perry, D.L.; Heinemann, H. Lawrence Berkeley Lab., CA (United States). Sep 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012759. Source: OSTI; NTIS; GPO Dep.

Research continued on the study of catalysts and membrane materials involved in the oxidative coupling of methane and coal gasification processes. Membranes studied and fabricated included Sr-Zr-Y-O, Sr-Zr-Y, and Sr-Ce-Y-O systems.

20566 (LBL–37028) **Fundamental studies of the mechanism of catalytic reactions with catalysts effective in the gasification of carbon solids and the oxidative coupling of methane. Quarterly report, October 1, 1994–December 31, 1994.** Iglesia, E.; Perry, D.L.; Heinemann, H. Lawrence Berkeley Lab., CA (United States). Dec 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012760. Source: OSTI; NTIS; GPO Dep.

This report describes research on the oxidative coupling of methane and catalysts involved in coal gasification. Topics include methane pyrolysis and catalysts, and magnetic properties of the coal gasification catalyst Ca-Ni-K-O system.

20567 (NEDO-C–9213) **Encouragement subsidies for the coal production/utilization. Next-generation coal utilization technology (first next-generation coal technology committee).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 77p. (In Japanese). Order Number DE95786803. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The present investigation report is a record of evaluation, discussion and deliberation in the first next-generation coal technology committee for the next-generation coal utilization, which was set forth by NEDO's 'Next-Generation Coal Technology Development Investigation' in fiscal 1993. In addition to the coal liquefaction and gasification both of which are being technologically developed by

the NEDO, this committee is to solve the environmental problem raised by the utilization of coal energy, expected to be increasingly consumed from now on, and design the measures for stabilizing the energy supply and demand. Then, they are to technologically evaluate, as a 'clean coal technology (CCT)', the next-generation coal utilization which innovatively covers the light load on environment, and both high-efficiency combustion and utilization of CO2 at the beginning of the 21st century. In the present first committee, the topping combustion, oxygen combustion, multi-function pyrolysis and coal cleaning were deliberated, while how to take the action for the NEDO-promoted CCT was discussed as a future plan of NEDO's next-generation coal technology development.

20568 (NEDO-C–9330) **Potential study of an environment harmony type coal utilization system. Potential study of an environment harmony type coal utilization system in the industrial sector in China.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Jun 1994. 635p. (In Japanese). Order Number DE95786811. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

An investigational study was conducted on a coal utilization system for environmental measures and improvement of efficiency in coal utilization in China. The present situation of the coal industry in a model area (Shandong Province) was surveyed. A model coal department was selected and a field survey was made. As a result, the following were proposed to the coal utilization system which the model coal department introduces: in the coal preparation field, jig is operated from manually to automatically. Unselected fine particle is treated by the high-grade reforming OA method. In the coal processing field, coal briquette produced by mixing desulfurizer into fine particle, change from the batch system to the continuing production system in the activated carbon plant. Execution of flotation, CWM production and introduction of a pipeline transportation system. As to coal combustion technology, introduction of the circulating fluidized bed boiler system. With relation to coal gasification technology, introduction of a system in which both ammonia and town gas are produced. In the coal ash utilization field, introduction of a plant of flue gas desulfurization sludge mixed sediment substituting materials, etc. 38 refs., 262 figs., 210 tabs.

20569 (SAND–95-2138C) **Evaluation of West Virginia University's iron catalyst impregnated on coal.** Stohl, F.V.; Diegert, K.V.; Goodnow, D.C. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9508133–1: Coal liquefaction and gas conversion contractor review meeting, Pittsburgh, PA (United States), 29-31 Aug 1995). Order Number DE95013835. Source: OSTI; NTIS; GPO Dep.

The objectives to evaluate and compare the activities/selectivities of fine-particle size catalysts being developed in the DOE/PETC Advanced Research (AR) Coal Liquefaction program by using standard coal liquefaction activity test procedures. Previously reported results have described the standard test procedure developed at Sandia to evaluate fine-particle size iron catalysts being developed in DOE/PETC's AR Coal Liquefaction Program and described the evaluation of several catalysts (commercially available pyrite, University of Pittsburgh's catalyst, Pacific Northwest Laboratories' catalyst) using these procedures. The test uses DECS-17 Blind Canyon Coal, phenanthrene as the reaction solvent, and a factorial experimental design that enables evaluation of a catalyst over ranges of temperature (350 to 400°C), time (20 to 60 minutes), and catalyst loading (0 to 1 wt % on an as-received coal basis). Recent work has focused on the evaluation of West Virginia University's iron catalyst that WVU impregnated on DECS-17 Blind Canyon coal. Results showed good activity for this catalyst including the highest amount of 9,10-dihydrophenanthrene (13.2%) observed in a reaction product and a small but significant catalytic effect for heptane conversion (0.5%). Additional experiments are being performed to enable comparison with previously tested catalysts. Tetrahydrofuran insolubles from selected reactions have been sent to the University of Kentucky for Mossbauer characterization of the iron phases present.

20570 (VTT-PUB–203) **Reactions of fuel bound nitrogen in gasification processes.** Leppaelahti, J. (VTT Energy, Espoo (Finland). Combustion and Conversion Technology). Technical Research Centre of Finland, Espoo (Finland). 1994. 144p. Order Number DE95779233. Source: OSTI; NTIS.

LIEKKI Research Programme, JALO Research Programme.

The formation of nitrogen compounds in fixed-bed and fluidized-bed gasifiers, their removal from hot gas and the formation of NO_x from nitrogen compounds were studied. The report consists of five papers. Paper 1 discusses conversion of peat and wood nitrogen in the fixed-bed gasifier and formation of NO_x, in combustion of gasification gas. In peat gasification, 19-30 whet% of fuel nitrogen was converted to H_3 but only 4 whet% of wood nitrogen formed H_3. HCN conversion was 3-5 whet% for peat and 9-14 whet% for wood. In papers 2 and 3, catalytic decomposition of nitrogen compounds and tars was studied. The activity of several catalytic materials was tested using a side stream of a commercially operated fixed-bed gasifier. The materials tested were iron sinter, iron pellet, ferrous dolomite, dolomite and limestone and, as reference materials, inert silicon carbide and a commercial nickel catalysts. The effect of process parameters on the formation of nitrogen compounds and tars in fluidized-bed air gasification of peat was studied in paper 4. In paper 5, the possibility of converting H_3 to N_2 by adding small amounts of O_2. NO or both to hot gasification product gases was studied by means of gas-phase kinetic modelling.

0105 Products and By-Products

20571 (DOE/EIA–0121(94/4Q)) **Quarterly coal report, October–December 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 23 May 1995. 181p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012807. Source: OSTI; NTIS; GPO; GPO Dep.

The Quarterly Coal Report (QCR) provides comprehensive information about US coal production, distribution, exports, imports, receipts, prices, consumption, and stocks to a wide audience, including Congress, Federal and State agencies, the coal industry, and the general public. Coke production, consumption, distribution, imports, and exports data are also provided. The data presented in the QCR are collected and published by the Energy Information Administration (EIA) to fulfill data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended. This report presents detailed quarterly data for October through December 1994 and aggregated quarterly historical data for 1986 through the third quarter of 1994. Appendix A displays, from 1986 on, detailed quarterly historical coal imports data, as specified in Section 202 of the Energy Policy and Conservation Amendments Act of 1985 (Public Law 99-58). Appendix B gives selected quarterly tables converted to metric tons.

0106 Properties and Composition

Refer also to citation(s) 20531, 20554, 20582, 20594

20572 (DOE/PC/90287–T18) **Oxidation of coal and coal pyrite mechanisms and influence on surface characteristics. Progress report.** Doyle, F.M. California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering. 28 Feb 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90287. Order Number DE95014324. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to develop a mechanistic understanding of the oxidation of coal and coal pyrite, and to correlate the intrinsic physical and chemical properties of these minerals, along with changes resulting from oxidation, with those surface properties that influence the behavior in physical cleaning processes. Work during the eighteenth quarter has focused on severe oxidation of coal by thermal and chemical treatment, and on investigating the partition of metal ions between such strongly oxidized coal samples and aqueous solutions. This partitioning behavior is being followed to obtain further information on the chemistry of the coal surfaces after different oxidation treatments, for example,

whether partition occurs by an ion-exchange mechanism, or whether the surface is capable of changing the oxidation state of metallic species, with concurrent surface or bulk precipitation.

20573 (DOE/PC/93051–T4) **Maintenance of the coal sample bank and database. Quarterly technical progress report, July 1, 1994–September 30, 1994.** Davis, A.; Glick, D.C. Pennsylvania State Univ., University Park, PA (United States). Coal and Organic Petrology Labs. 27 Feb 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93PC93051. Order Number DE95010623. Source: OSTI; NTIS; GPO Dep.

This five year project is intended to ensure the availability of well-characterized, high-quality coal samples for public and private coal research. it continues support of the DOE Coal Sample Bank and Database at The Pennsylvania State University. Thirty coal samples will be collected, processed, packaged, and analyzed, and a resulting database will be maintained. These samples and data, as well as 26 samples collected under previous contracts, will be distributed to DOE contractors and others performing coal research. Samples will be chosen to maintain a sample bank of 56 coals representing the major US coal fields and a variety of coal ranks and compositions. In addition to standard analyses, liquefaction tests and organic geochemical analyses will be performed. The samples will be stored to minimize deterioration, and will be monitored annually by proximate, sulfur forms, and gaseous oxygen analysis to evaluate their condition. These samples will be used for additional research on the influence of changes in surface chemistry on surface properties, the influence of sample deterioration on liquefaction properties, and the mechanisms of coal oxidation.

0108 Waste Management

Refer also to citation(s) 20536, 20570, 20586, 20587, 20592, 21154, 21161, 21163, 21164, 21352

20574 (ANL/ES/CP–86103) **Alternative flue gas treatment technologies for integrated SO_2 and NO_x control.** Markussen, J.M. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Livengood, D.D. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950414–3: 57. annual American power conference, Chicago, IL (United States), 18-20 Apr 1995). Order Number DE95012919. Source: OSTI; NTIS; GPO Dep.

Enactment of the 1990 Clean Air Act Amendments, as well as passage of legislation at the state level has raised the prospect of more stringent nitrogen oxides (NO_x) emission regulations and has fueled research and development efforts on a number technologies for the combined control of sulfur dioxide (SO_2) and NO_x. The integrated removal of both SO_2 and NO_x in a single system can offer significant advantages over the use of several separate processes, including such factors as reduced system complexity, better operability, and lower costs. This paper reviews the status of a number of integrated flue gas cleanup systems that have reached a significant stage of development, focusing on post-combustion processes that have been tested or are ready for testing at the pilot scale or larger. A brief process description, a summary of the development status and performance achieved to date, pending commercialization issues, and process economics (when available) are given for each technology.

20575 (DOE/MC/22118–3942) **Design manual for management of solid by-products from advanced coal technologies.** Radian Corp., Austin, TX (United States). Oct 1994. 305p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC22118. Order Number DE95000037. Source: OSTI; NTIS; GPO Dep.

Developing coal conversion technologies face major obstacles in byproduct management. This project has developed several management strategies based on field trials of small-scale landfills in an earlier phase of the project, as well as on published/unpublished sources detailing regulatory issues, current industry practice, and reuse opportunities. Field testing, which forms the basis for several of the disposal alternatives presented in this design manual, was limited to byproducts from Ca-based dry SO_2 control technologies, circulating fluidized bed combustion ash, and bubbling bed fluidized bed combustion ash. Data on byproducts from other advanced coal technologies and on reuse opportunities are drawn from other sources (citations following Chapter 3). Field results from the 5 test cases examined under this project, together with results from other ongoing research, provide a basis for predictive modeling of long-term performance of some advanced coal byproducts on exposure to ambient environment. This manual is intended to provide a reference database and development plan for designing, permitting, and operating facilities where advanced coal technology byproducts are managed.

20576 (DOE/MC/28162–4013) **Coolside waste management research. Annual report, October 1, 1993–September 1994.** Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. 28 Nov 1994. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-91MC28162. Order Number DE95011611. Source: OSTI; NTIS; GPO Dep.

Properties of the waste product fly ash, resulting from fluidized bed combustion, were investigated. Work was initiated to determine if the fly ash could be used as a soil stabilizing material. Leachates, ionic strength, ph value, and compressive strength were evaluated.

20577 (DOE/MC/30251–4034) **High-volume, high-value usage of flue gas desulfurization (FGD) by-products in underground mines: Phase 1, Laboratory investigations. Quarterly report, October–December 1994.** Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. Mar 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30251. Order Number DE95000097. Source: OSTI; NTIS; GPO Dep.

Research under Subtask 2.2, Chemical and Mineralogical Characterization, included further refinement of mineralogical transformation and the initiation of a kinetic study. The expansion of the FGD materials during moisturizing is attributable to three reactions: the hydration of portlandite to slaked lime; the formation of ettringite from fly ash and anhydrite, and; the formation of gypsum from anhydrite. The sequence of these reactions are being examined in a kinetic study. Completion of the first 15 days of study finds the steady decrease in anhydrite with concomitant formation of ettringite (on fly ash surfaces) and gypsum (pore and crack in-fillings). Geotechnical characterization (Subtask 2.3) focused on swell experiments which will model in situ emplacement. Specimens of FGD material have been stored in 3-inch diameter pipe and, after 39 days, 0.5% of axial swell has been recorded with material strengths of 600 to 1,000 psi. Experiments to determine the amount of moisture loss due to the heat of hydration indicate about 9 to 10% of the water is lost. Confined swell tests are also underway with pressures of 15 to 20 psi recorded at 25 days. Work performed under Task 4 (Background for Phase II) included determination of the compressive strengths for the experimental mine roof rock. Values in the 5,000 to 7,500 psi range were found, which is typical for this type of strata in the region. Work on the hydrologic monitoring program (Subtask 4.2) included completion of the hydraulic conductivity assessment of the strata, as well as completion of the monitoring well plan. The highest hydraulic conductivity was found for the Princess No. 3 coal seam with values of 1×10^{-3} feet/min. The weathered sandstone over the coal had conductivities in the 10^{-4} to 10^{-5} feet/min. range.

20578 (DOE/MC/30252–4024) **Management of dry flue gas desulfurization by-products in underground mines. Quarterly report, October–December 1994.** Chugh, Y.; Dutta, D.; Esling, S.; Ghafoori, N.; Paul, B.; Sevim, H.; Thomasson, E. Southern Illinois Univ., Carbondale, IL (United States). Jan 1995. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30252. Order Number DE95000094. Source: OSTI; NTIS; GPO Dep.

On September 30, 1993, the US Department of Energy, Morgantown Energy Technology Center and Southern Illinois University at Carbondale (SIUC) entered into a cooperative agreement entitled "Management of Dry Flue Gas Desulfurization By-Products in Underground Mines" (DE-FC21-93MC30252). Under the agreement, Southern Illinois University at Carbondale will develop and demonstrate several technologies for the placement of coal combustion

residues in abandoned coal mines, and will assess the environmental impact of such underground residues placement. The major event during the quarter was the demonstration of the SEEC, Inc. technology for loading and transporting coal combustion residues in the SEEC developed Collapsible Intermodal Containers (CIC). The demonstration was held on November 17, 1994, at the Illinois Power Company Baldwin power plant, and was attended by about eighty (80) invited guest. Also during the quarter meetings were held with Peabody Coal Company officials to finalize the area in the Peabody No. 10 mine to be used for the placement of coal combustion residues. Work under the Materials Handling and Systems Economics area continued, particularly in refining the costs and systems configuration and in economic evaluation of various systems using equipment leasing rather than equipment purchases. Likewise, work progressed on residues characterization, with some preparations being made for long-term testing.

0109 Environmental Aspects

Refer also to citation(s) 20567, 20597, 20717, 20718, 20719, 20720, 21165, 21170, 21348, 22317

20579 (INIS-BR–3523) **Environmental Impact Report for thermoelectric from coal in Candiota region - Brazil.** Rossato, A.C. (Companhia Estadual de Energia Eletrica do Estado do Rio Grande do Sul, Porto Alegre, RS (Brazil)); Camison, F.L.; Ladniuk, S.T. Companhia Paranaense de Energia (COPEL), Curitiba, PR (Brazil). 1989. 4p. (In Portuguese). (CONF-8910591–: 10. national seminar on production and transmission of electric power, Curitiba (Brazil), 1-5 Oct 1989). Order Number DE95633430. Source: OSTI; NTIS (US Sales Only); INIS.

The principles for executing the Environmental Impact Studies and the elaboration of Environmental Impact Report, referring to the first module of Candiota III Thermoelectric Plant, near to the Electric Energy State Company are described, with some aspects about the mine, plant, region, executor corporations and comprehend area for the environmental impact studies. (C.G.C.).

0120 Mining

Refer also to citation(s) 20577, 20578

20580 (ETDE/JP-mf–95787235) **Forty years of mechanization of coal mines.** Watanabe, T. Coal Mining Research Centre (Japan). Oct 1994. 280p. (In Japanese). Order Number DE95787235. Source: OSTI; NTIS; Available from Coal Mining Research Center, Japan, 2-10, Kanda Jinbocho, Chiyoda-ku, Tokyo, Japan.

As for the mechanism of coal mines in Japan today, techniques are introduced such as iron prop, hinged bar, coal mining, timbering and maintenance of drilling mine roadway, drilling, transport, and slurry transportation. To support working faces with iron frame, friction iron props are introduced, and hinged bar mining is conducted. As machine coal mining, conducted are coal planer mining and cutter mining. Intending unmanned coal mining, self-advancing support is practically applied. Mechanization of steep slope coal mining and hydraulic mining are researched and practically applied. The pneumatic rock drill, hydraulic rock drill and drilling machine (jumbo drill) are used for mechanization of drilling. As loading machine, used are scraper loader, shaker loader, gathering loader, bucket type loader, etc. All cross section advancing machine and ultra-high pressure combined-use advancing machine are used. Bolt timbering is widely used. Together with employment of various types of engines, hydraulic transportation is studied. Technology for mechanizing coal mine in Japan is at a highest level in the world, and therefore efforts should be exerted to make it useful for development of coal mines overseas. 293 refs., 518 figs., 64 tabs.

0130 Transport, Handling, and Storage

20581 (DOE/PC/90184–T18) **Nuclear magnetic resonance study of granular flows. Final report.** Lovelace Insts., Albuquerque, NM (United States). Mar 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90184. Order Number DE95015601. Source: OSTI; NTIS; GPO Dep.

We have demonstrated the efficacy of NMRI to granular flow studies of objects that yield NMR signals (seeds, pharmaceutical pills) in confined spaces (rotating cylinders, shaking boxes). Excellent results for velocity and concentration of flowing and colliding particles have been obtained non-invasively. We studied flows in geometries that are otherwise impossible to study because of the optical opacity of the materials. In addition, we obtained data for diffusion and collisional losses which must be related to granular temperature. We also measured the global collisional and frictional energy loss for a rotating cylinder containing granular material and compared it to that obtained from the NMRI velocity and acceleration data. We used the same NMR technique to study the interplay between radial and axial segregation of heterogeneous particles in a partially filled rotating cylinder. We also measured flow and diffusion of vibrating particles in the NMRI apparatus to ascertain that such experiments are, indeed, possible. Some theoretical studies were initiated to explain some of the velocity profiles and free surface shapes of rotating drum flow. A direct numerical simulation of the drum flow successfully predicted a number of features, including velocity, concentration, and dissipation profiles in rotating cylinders.

20582 (DOE/PC/92578–T7) **Coal log pipeline research at the University of Missouri. 4th Quarterly report for 1994, October 1, 1994–December 31, 1994.** Liu, H.; Wilson, J.W. Missouri Univ., Columbia, MO (United States). Capsule Pipeline Research Center. [1995]. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93PC92578. Order Number DE95012450. Source: OSTI; NTIS; GPO Dep.

Several factors involved in coal log fabrication, storage and handling, such as curing time, aspect ratio and particle size distribution, were evaluated during the fourth quarter of 1994. When Orimulsion is used for coal log fabrication, a certain period of time is required to build up the strength of coal log. From the test results obtained, the longer the curing period the greater the wear resistance of the coal log. From previous studies, the coal log length to diameter ratio (aspect) was found to be an important factor affecting coal log performance during the pipeline degradation test. From the 2 inches pipeline degradation test results, coal logs with aspect ratios ranging from 1.6 to 2.2 traveled in a more stable manner, and had lower weight loss than coal logs with aspect ratios less than 1.6. The influence of particle size on the performance of a coal log was evaluated to determine the optimum particle size for coal log fabrication, based on practical and economical considerations.

20583 (MAE–304) **Couette flows of a granular monolayer: An experimental study.** Elliott, K.E.; Ahmadi, G.; Kvasnak, W. Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering. Mar 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91297 ; FG22-94PC94213. Order Number DE95015963. Source: OSTI; NTIS; GPO Dep.

An experimental study concerning rapid flows of granular materials in a two dimensional planar granular Couette flow apparatus is performed. The device is capable of generating particulate flows in grain-inertia regime at different shearing rates and solid volume fractions. Multi-color spherical glass particles are sheared across an annular test-section for several wall angular velocities. A video recorder is used to record the motion of particles, and consecutive images are stored and analyzed by an image processing technique for evaluating individual grain velocities. Experimental data for the mean velocity, the root mean-square fluctuation velocity components and the solid volume fraction profile are obtained. The resulting mean velocity profiles have a roughly linear variation for the range of solid volume fractions and shear rates studied. The solid volume fraction profiles exhibit nonuniform variations with the highest concentration occuring near the center of the shearing cell. The RMS-fluctuation velocities are roughly constant, with the streamwise fluctuation being somewhat larger than the cross-stream direction. The experimentally measured flow properties are in reasonable agreement with the earlier theoretical and simulation results.

0140 Combustion

Refer also to citation(s) 20529, 20532, 20567, 20576, 20583, 21154, 21711

20584 (ANL/ET/CP–86087) **Corrosion performance of materials for advanced combustion systems.** Natesan, K. (Argonne National Lab., IL (United States)); Freeman, M.; Mathur, M. Argonne National Lab., IL (United States). May 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505204–3: 9, annual conference on fossil energy materials, Oak Ridge, TN (United States), 16-18 May 1995). Order Number DE95013532. Source: OSTI; NTIS; GPO Dep.

Conceptual designs of advanced combustion systems that utilize coal as a feedstock require high-temperature furnaces and heat transfer surfaces capable of operating at much higher temperatures than those in current coal-fired power plants. The combination of elevated temperatures and hostile combustion environments requires development and application of advanced ceramic materials for heat exchangers in these designs. This paper characterizes the chemistry of coal-fired combustion environments over the wide temperature range of interest in these systems and discusses some of the experimental results for several materials obtained from laboratory tests and from exposures in a pilot-scale facility.

20585 (CONF-940780–9) **Development and testing of a high efficiency advanced coal combustor: industrial boiler retrofit.** Jennings, P.L. (Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs.); Borio, R.W.; Miller, B.G.; Scaroni, A.W.; McGowan, J.G. ABB Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91160. From 10. annual coal preparation, utilization and environmental control contractors conference; Pittsburgh, PA (United States); 18-21 Jul 1994. Order Number DE95012013. Source: OSTI; NTIS; GPO Dep.

Under U.S. Department of Energy, Pittsburgh Energy Technology Center (PETC) support, the development of a High Efficiency Advanced Coal Combustor (HEACC) has been in progress since 1987 at the ABB Power Plant Laboratories. As summarized in previous publications on the subject, the initial work produced an advanced coal firing system that was capable of firing both water-based and dry pulverized coal in an industrial boiler environment. With continued DOE-PETC support, carried out in cooperation with the Energy and Fuels Research Center of The Pennsylvania State University (Penn State), the HEACC burner concept has been used as a major component in a system design intended for industrial-scale, coal fired retrofit applications. The overall objective of the current work is to demonstrate the technical and economic feasibility of retro a gas/oil-designed industrial boiler to burn micronized coal. In this respect, the major technical goals for the combustion system design have included: a compact, easy to retrofit burner design; low NOx generation, while maintaining high combustion efficiency; commercially acceptable combustion air pressure drop and burner turndown ratio; and integration of coal preparation system controls into boiler control system The design of the HEACC burner is based on the well established principle of internal air staging for NOx control.

20586 (DOE/PC/79796–T38-Vol.2) **Enhancing the use of coals by gas reburning-sorbent injection. Volume 2, Gas reburning-sorbent injection at Hennepin Unit 1, Illinois Power Company.** Energy and Environmental Research Corp., Bartonville, IL (United States). Oct 1994. 376p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States);Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FC22-87PC79796. Order Number DE95009448. Source: OSTI; NTIS; GPO Dep.

A Clean Coal Technology (CCT) Project has been completed at a 71 MW(e) (net) tangentially fired unit in Hennepin, Illinois. Energy and Environmental Research Corporation (EER) has demonstrated Gas Reburning-Sorbent Injection (GR-SI) to reduce emissions of NO_x and SO_2, by 60 and 50%, respectively. The host unit was Illinois Power's Hennepin Station Unit 1 which normally fires an Illinois bituminous coal containing approximately 3% sulfur. EER designed and retrofitted the GR-SI system, then evaluated its performance over a year-long demonstration. With GR-SI, natural gas is injected into the furnace above the coal burners to reduce NO_x to N_2 and dry hydrated lime sorbent is injected into the upper furnace for SO_2 capture. Natural gas is injected, at a rate corresponding to 18% of the total heat input, to form a fuel rich reducing zone in which NO_x formed in the coal zone is reduced to N_2. Overfire (burnout) air is injected at a higher point in the boiler to burnout fuel combustibles under overall fuel lean conditions. Hydrated Lime, $Ca(OH)_2$, is injected into the upper furnace cavity through front and side wall injectors, at a rate corresponding to a calcium (sorbent) to sulfur (coal) molar ratio of 1.75. Over the year-long GR-SI demonstration the average NO_x reduction was 67%, from the 0.75 lb/MBtu (323 mg/MJ) coal baseline, and the average SO_2 reduction was 53%, from the 5.3 lb/MBtu (2280 mg/MJ) coal baseline. The average calcium utilization with Linwood hydrated lime sorbent was 24%. Low emissions of CO were maintained, with an average of 57 ppM (@ 3% O_2). Reduction of CO_2 emissions of 7%, from 15.6 to 14.5% (@ 3% O_2), was also measured.

20587 (DOE/PC/79796–T42) **Enhancing the use of coals by Gas Reburning: Sorbent Injection. [Quarterly report], July 28–October 1, 1993.** Energy and Environmental Research Corp., Irvine, CA (United States). Feb 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-87PC79796. Order Number DE95012445. Source: OSTI; NTIS; GPO Dep.

Energy and Environmental Research Corporation (EER) has completed demonstrations of Gas Reburning-Sorbent Injection (GR-SI) at two field sites. The discussions which follow pertain to measurements taken from the demonstration at City Water, Light and Power's (CWLP) Lakeside Station Unit 7 in Springfield, Illinois. Environmental monitoring was conducted for two purposes, to satisfy the requirements of operating permits granted by the Illinois Environmental Protection Agency (IEPA) and to verify environmental acceptability of the GR-SI process. The GR-SI demonstration program at Lakeside Unit 7 was performed in three phases. Phase I – Design and Permitting, entailed characterization of the host boiler, then finalization of process and engineering, design of the GR-SI system. Phase I was initiated in June 1987 and completed in March 1989. Phase II – Construction and Startup, was initiated upon completion of design tasks and was completed in February 1993. Phase III – Operation, Data Collection, Reporting and Disposition, was conducted from July 1993 to June 1994. In Phase III, the GR-SI system performance was evaluated initially through optimization tests, which are short-term tests in which specific operating parameters are varied to determine their impact on emissions and boiler performance. The optimization testing included GR only tests, SI only tests, and GR-SI tests. Results from these tests, carried out from July 28 to October 1, 1993, are presented in this report. Following Optimization testing, long-term GR-SI operation was initiated to demonstrate the combined technology over an extended period with the unit under dispatch load control. Long-term GR-SI testing was conducted from October 4, 1993 to June 3, 1994. The long-term environmental monitoring data are presented in a separate report.

20588 (DOE/PC/88697–T10) **Coal-water slurry fuel combustion testing in an oil-fired industrial boiler. Semiannual technical progress report, February 15, 1994–August 15, 1994.** Miller, B.G.; Scaroni, A.W. Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center. 30 Nov 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-89PC88697. Order Number DE95011388. Source: OSTI; NTIS; GPO Dep.

The Pennsylvania State University is conducting a coal-water slurry fuel (CWSF) program for the United States Department of Energy (DOE) and the Commonwealth of Pennsylvania with the objective of determining the viability of firing CWSF in an industrial boiler designed for heavy fuel oil. The project will also provide information to help in the design of new system specifically configured to fire these clean coal-based fuels. The project consists of four phases: (1) design, permitting, and test planning, (2) construction and start up, (3) demonstration and evaluation (1,000-hour demonstration), and (4) expanded demonstration and evaluation (installing a CWSF preparation circuit, conducting an additional

1,000 hours of testing, and installing an advanced flue gas treatment system). The boiler testing and evaluation will determine if the CWSF combustion characteristics, heat release rate, fouling and slagging behavior, corrosion and erosion tendencies, and fuel transport, storage, and handling characteristics can be accommodated in a boiler system designed to fire heavy fuel oil. In addition, the proof-of-concept demonstration will generate data to determine how the properties of a CWSF and its parent coal affect boiler performance. The economic factors associated with retrofitting boilers will also be evaluated. During this reporting period, the construction of the CWSF preparation circuit (as well as a dry, micronized coal circuit) continued. The CWSF preparation circuit will be completed by November 1,1994. Additional activities included receiving a coal-designed burner and installing it on the demonstration boiler, and working with DOE in selecting pollution control systems to install on the boiler.

20589 (DOE/PC/90155–T13) **Development and testing of commercial-scale, coal-fired combustion systems: Phase 3, Technical progress report, October 1993–December 1993.** Manufacturing and Technology Conversion International, Inc., Columbia, MD (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90155. Order Number DE95011476. Source: OSTI; NTIS; GPO Dep.

The objective of this Phase III program for the development of a commercial scale, coal-fired combustion system is to develop and integrate all system components from fuel through total system controls building upon the prior Phase I and II development accomplishments of the MTCI pulse combustion technology and to then field test the complete system in order to evaluate its potential marketability. During this 13th quarter, a steam generation cost model was developed to compare the economics of steam production in the commercial-scale, coal-fired pulse combustion system with that in a natural gas- or oil-fired system. The purpose of this model is to define the competitive capital cost range for the MTCI system under a specified set of technical and economic conditions. A current preliminary estimate of the MTCI pulse coal combustion system capital cost turns out to be about $120,000 and this is within the target range of the US commercial boiler market sector. European differential fuel costs are expected to be more favorable. Several conceptual arrangements for coal reburn and char burnout were evaluated. The arrangement was selected based on the following considerations viz. utilization of the existing pulse combustor as is, minimization of footprint and vertical space requirement, good mixing of coal, steam and combustion products in the reburn section, and adequate char residence time in the char burnout section.

20590 (DOE/PC/91160–T5) **Development and testing of a high efficiency advanced coal combustor: Phase 3 industrial boiler retrofit. Quarterly technical progress report No. 11, April 1, 1994–June 30, 1994.** Patel, R. (ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs.); Borio, R.; Scaroni, A.W.; Miller, B.G.; McGowan, J.G. ABB Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs. 23 Sep 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91160. Order Number DE95011927. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to retrofit the previously developed High Efficiency Advanced Coal Combustor (HEACC) to a standard gas/oil designed industrial boiler to assess the technical and economic viability of displacing premium fuels with microfine coal. This report documents the technical aspects of this project during the tenth quarter of the program. The four hundred hours "Proof-of-Concept System Test" under Task 3 was completed during this quarter. The primary objectives were to obtain steady state operation consistently on coal only and increase carbon conversion efficiency from ~95% to the project goal of 98%. This was to be obtained without increasing NO_x emission above the project goal level of 0.6 lbs/MBtu (~425 ppM). The testing was also designed to show that consistent, reliable operation could be achieved as another prerequisite to the demonstration. The data were gathered and analyzed for both economic and technical analysis prior to committing to the long term demonstration. The Economic Evaluation was completed and work started on commercialization plan. During this reporting period, activities included sample analysis, data reduction and interpretation from all the testing during March and April. Following preliminary conclusions are drawn based on results evaluated: coal handling/preparation system can be designed to meet technical requirements for retrofitting microfine coal combustion; boiler thermal performance met requirement; NO_x Emission can meet target of 0.6 lb/MBtu; combustion efficiencies of 95% could be met on a daily average basis, somewhat below target of 98%; economic playback very sensitive to fuel differential cost, unit size, and annual operating hours; and continuous long term demonstration needed to quantify ash effect and how to best handle.

20591 (DOE/PC/92159–T10) **Engineering development of advanced coal-fired low-emission boiler systems. Technical progress report No. 9, September 1994–December 1994.** ABB Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs. 27 Mar 1995. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92159. Order Number DE95010652. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the U.S. Department of Energy (DOE) has contracted with Combustion Engineering, Inc. (ABB CE) to perform work on the "Engineering Development of Advanced Coal-Fired Low-Emission Boiler Systems" Project and has authorized ABB CE to complete Phase I on a cost-reimbursable basis and Phases II and III on a cost-share basis. The overall objective of the Project is the expedited commercialization of advanced coal-fired low-emission boiler systems. The specified primary objectives are: (1) NO_x emissions not greater than one-third NSPS; (2) SO_x emissions not greater than one-third NSPS; (3) Particulate emissions not greater than one-half NSPS. The specific secondary objectives are: (1) Improved ash disposability and reduced waste generation; (2) Reduced air toxics emissions; (3) Increased generating efficiency. The final deliverables are a design data base that will allow future coal-fired power plants to meet the stated objectives and a preliminary design of a Commercial Generation Unit. The work in Phase I covered a 24-month period and included system analysis, RD&T Plan formulation, component definition, and preliminary Commercial Generating Unit (CGTJ) design. Phase II will cover a 15-month period and will include preliminary Proof-of-Concept Test Facility (POCTF) design and subsystem testing. Phase III will cover a 9-month period and will produce a revised CGU design and a revised POCTF design, cost estimate and a test plan. Phase IV, the final Phase, will cover a 36-month period and will include POCTF detailed design, construction, testing, and evaluation.

20592 (DOE/PC/92159–T11) **NOx control subsystem test plan: LEBS Phase II.** Combustion Engineering, Inc., Windsor, CT (United States). 16 Mar 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92159. Order Number DE95012419. Source: OSTI; NTIS; GPO Dep.

It is planned that NO_x control subsystem testing in support of Phase II of the Low-Emissions Boiler Systems (LEBS) Project occur in ABB Power Plant Laboratories' (PPL) pilot scale Boiler Simulation Facility (BSF). This work will be performed to provide necessary design and operational information for inclusion of an optimized NO, control subsystem in the Proof-of-Concept Test Facility (POCTF) and Commercial Generating Unit (CGU) designs. The BSF is a 50 to $90x10^6$ BTU/hr (15 to 26 MWt) coal, oil or natural gas fired tangential furnace designed to replicate the residence time/temperature history of a utility scale tangentially fired boiler. All major aspects of a typical utility boiler are duplicated in the BSF including the lower furnace, the ash hopper, multiple burner elevations, the arch section, superheater/reheater panels, and the convective heat transfer surfaces. The furnace walls and heat transfer surfaces are cooled by a surrounding water jacket. Steam generated is vented off at atmospheric pressure so that a constant sink temperature of 100°C (212°C) is maintained. The lower furnace water walls are selectively refractory lined to maintain an appropriate furnace gas temperature history. Refractory is required because the sink temperature (100°C) is cooler than that of a typical, utility boiler, and the surface-to-volume ratio of the BSF is greater than that of a utility boiler due to scale effects. For the subject testing, the BSF will be configured as a coal fired

boiler. Design and planning activities associated with the construction of the NO_x control subsystem test unit will continue through June, 1995. Additionally, the schedule for specification of certain low NO_x firing system components was set to allow for precursor, internal and LEBS development activities to occur and subsequently provide necessary design parameters.

20593 (DOE/PC/92528–9) **Char particle fragmentation and its effect on unburned carbon during pulverized coal combustion. Quarterly report, October 1–December 31, 1994.** Mitchell, R.E. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Mar 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92528. Order Number DE95012428. Source: OSTI; NTIS; GPO Dep.

The project is intended to satisfy, in part, PETC's research efforts to understand the chemical and physical processes that govern coal combustion. The work is pertinent to the char oxidation phase of coal combustion and focuses on how the fragmentation of coal char particles affects overall mass loss rates and how char fragmentation phenomena influence coal conversion efficiency. The knowledge and information obtained will allow the development of engineering models that can be used to predict accurately char particle temperatures and total mass loss rates during pulverized coal combustion. The overall objectives of the project are: (1) to characterize fragmentation events as a function of combustion environment, (2) to characterize fragmentation with respect to particle porosity and mineral loadings, (3) to assess overall mass loss rates with respect to particle fragmentation, and (4) to quantify the impact of fragmentation on unburned carbon in ash. The knowledge obtained during the course of this project will be used to predict accurately the overall mass loss rates of coals based on the mineral content and porosity of their chars. The work will provide a means of assessing reasons for unburned carbon in the ash of coal fired boilers and furnaces.

20594 (DOE/PC/93226–T6) **Investigation of mineral transformations and ash deposition during staged combustion. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Harb, J.N. Brigham Young Univ., Provo, UT (United States). 4 May 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93226. Order Number DE95014339. Source: OSTI; NTIS; GPO Dep.

Progress during the sixth quarter of a three-year study was made in two task areas: (1) parametric testing of the target coals, and (2) analysis of samples from the combustion tests. A new microanalysis system was acquired (no cost to DOE) and is now functional, although development of analysis routines for the system is still in progress. This system has significantly increased our analytical throughput and has provided increased reliability. Parametric testing of the Pittsburgh No. 8 coal (weathered) was initiated this quarter. Initial analytical results from these tests show sulfur release and iron transformations as a function of test conditions and sampling location. A new supply of Pittsburgh No. 8 coal has been shipped and will be used to contrast behavior between the oxidized (weathered) and unoxidized Pittsburgh fuels. Finally, specific tasks for the next quarter have been identified and reported.

20595 (RISO-R–778(EN)) **Department of Combustion Research annual progress report 1 January - 31 December 1994.** Hauge Madsen, P.; Petersen, S. (eds.). Risoe National Lab., Roskilde (Denmark). Combustion Dept. Mar 1995. 69p. Order Number DE95779213. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

The Department of Combustion Research performs research and development in the programme area of combustion and gasification. The research is aimed at improving the technical and scientific basis for the design and operation of combustion and gasification plants. The overall objective is to contribute to a reduced environmental impact and improved energy efficiency and economy Basic as well as applied research is performed in a number of projects, which have been structured in two research programmes: Chemical and physical characterization of fuels and processes and Optimization of combustion and gasification technologies. The main research activities and results are surveyed in this Progress Report covering the period of 1 January to 31 December 1994. In addition other activities, equipment and facilities, staff and publications are briefly presented. (au)

20596 (SAND–95-8228) **Coal combustion science quarterly progress report, January 1994–March 1994.** Hardesty, D.R. (ed.); Baxter, L.L.; Davis, K.A.; Hurt, R.H. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010743. Source: OSTI; NTIS; GPO Dep.

Research on coal combustion is reported. Topics include: kinetics and mechanisms of coal char combustion and deposit growth in coal-fired furnaces. Algorithms were developed for ash deposit properties. Chemical transformations and ash deposition were investigated utilizing FTIR spectroscopy and a new probe designed to provide temperatures at four locations and temperature changes of the cooling fluid across the center section of the probe. Spectral emissivity of ashes from several different coals are presented. Scanning electron microscopy images of deposits are also presented.

0150 Economic, Industrial, and Business Aspects

20597 (NEDO-C–9331) **Potential survey of an environment harmony type coal utilization system. Potential survey of an environment harmony type coal utilization system in sectors except the coal industry in China.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Jun 1994. 557p. (In Japanese). Order Number DE95786812. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

To work out a master plan for introducing the coal utilization system to China, a survey was made of a system for improvement of the environment and efficiency in coal utilization in China. With the annual economic growth rate exceeding 12%, China consumes 1.1 billion tons of coal and is faced with the serious environmental problem. To realize the continuable growth, Japan and China agreed on cooperation for the green aid plan which positively supports self-aiding efforts exerted by each country. Based on this, the survey is planned to be made for three years from fiscal 1993 on the economy/energy problem, coal utilization status, various industries and their applicable environmental technologies, and coal distribution status. For improvement of coal utilization efficiency, it is necessary to introduce advanced combustion technology, gasification technology, technology to use coal briquette and coal ash. For environmental measures, required are ash collecting, desulfurization, denitrification technologies, which need plant/equipment investment and running cost. For steady economic growth of China, it is necessary for Japan to have much discussion with China and frame a total scheme on technology transfer from Japan and utilization of by-products, etc. 15 refs., 101 figs., 282 tabs.

0160 Health and Safety

Refer also to citation(s) 21168

20598 (BNL–61521) **A systems approach to risk assessment: Application to methylmercury from coal combustion.** Saroff, L. (Dept. of Energy, Washington, DC (United States)); Lipfert, F.W.; Moskowitz, P.D. Brookhaven National Lab., Upton, NY (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950313–1: 20. international technical conference on coal utilization and fuels systems, Clearwater, FL (United States), 20-23 Mar 1995). Order Number DE95008858. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) asked Brookhaven National Laboratory (BNL) to perform a probabilistic assessment of the health risks associated with Hg from coal-fired power plants. The objective of the assessment is to estimate the incremental health risks that might ensue from a typical coal-fired power plant, together with their uncertainties, taking into account existing background levels and the actual adverse health effects that have

previously been associated with exposure to various Hg species. Mercury has a long history of association with adverse neurological effects at high exposure levels. The most important current exposure pathway has been found to be ingestion of fish containing methylmercury (MeHg), which is the end product of bioconcentration moving up the aquatic food chain. Mercury can enter natural waters from either industrial discharges or from atmospheric deposition of various inorganic Ho. compounds. Because of the worldwide background and the existence of local emissions sources, Hg deposition must be considered on local, regional and global scales. The regulatory technical challenge presented by methy1mercury is to protect public health without foreclosing an appreciable a portion of the food supply or impacting on the lifestyles of North American native populations. This paper presents an abbreviated account of the DOE/BNL risk assessment, as viewed from a systems perspective. We review the structure of the model, the sources of data used, the assumptions that were made, and the interpretation of the findings. Since publication of the first risk assessment report, we have refined our estimates of local atmospheric dispersion and deposition and "calibrated" the pharmacokinetic portion of the model against observations.

20599 (ETDE-DE–111) **Branch project mining industry: Development of a system for epidemiological analyses in the occupational medicine (SEPIA). Final report.** Piekarski, C. Ruhrkohle AG, Essen (Germany). Jan 1995. 264p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 01HD010. Order Number DE95777859. Source: OSTI; NTIS (US Sales Only).

According to Art. 3 of the German Law on Safety at Work the occupational health physicians are held 'to investigate into the causes of occupational diseases'. The project was designed to develop an instrument in occupational medicine with Ruhrkohle AG, to detect possible health impairments in coalworkers as soon as possible and to judge quantitatively health risks due to occupational exposure. By this way the system supplies a scientifc basis for direct protective measures as well as for discussions in health politics. During the project a data processing system was established, that logs all exposure (stress) and health related (strain) data of the workers sampled routinely by the personnel departements, departements of occupational safety and health dispensaries. The data are stored in the dispensary's computer with the occupational physicians in charge to support daily work and the performing of epidemiological studies. As a result the System for Epidemiological Analyses in Occupational Medicine (SEPIA) was realized which consists of a subsystem in the health dispensary (SEPIA-AMD) and other subsystem designed for epidemiological studies on the company scale in the Institute of Occupational Health with RAG (SEPIA/IfA). SEPIA-AMD provides a computer-assisted-system serving all medical workplaces, exchanging data online between system and all measuring devices for medical diagnostics and storing even all graphical data of these devices. SEPIA-IfA establishes an instrument for occupational epidemiology at the company, i.e. the design and performance of epidemiological studies as well as the development of epidemiological methods. For this purpose a computer system with an entire data base and statistical software for analyses was installed. SEPIA is a modular and highly flexible system which can be easily transfered to other medium or large companies with own occupational health dispensaries. (orig.)

0170 Legislation and Regulations

20600 (NREL/SP–440-6642) **Wind energy bibliography.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94006896. Source: OSTI; NTIS; GPO Dep.

This bibliography is designed to help the reader search for information on wind energy. The bibliography is intended to help several audiences, including engineers and scientists who may be unfamiliar with a particular aspect of wind energy, university researchers who are interested in this field, manufacturers who want to learn more about specific wind topics, and librarians who provide information to their clients. Topics covered range from the history of wind energy use to advanced wind turbine design. References for wind energy economics, the wind energy resource, and environmental and institutional issues related to wind energy are also included.

02 PETROLEUM

Refer also to citation(s) 21395, 21420

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 20610, 20616, 20617, 20620, 20621, 20623

20601 (DOE/BC/14471–19) **Results and synthesis of integrated geologic studies of the carboniferous Lisburne Group of Northeastern Alaska. Final report.** Watts, K.F. Alaska Univ., Fairbanks, AK (United States). May 1995. 433p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14471. Order Number DE95000123. Source: OSTI; NTIS; GPO Dep.

The primary objective of this project was to develop an integrated database to characterize reservoir heterogeneities resulting from numerous small-scale shallowing-upward cycles (parasequences) comprising the Pennsylvanian Wahoo 1imestone. The Wahoo Limestone is the upper part of an extensive carbonate platform sequence of the Carboniferous Lisburne Group which is widely exposed in the Brooks Range and is a widespread hydrocarbon reservoir unit in the subsurface of the North Slope of Alaska. A leading goal is to determine lateral and vertical variations in the complex mosaic of carbonate facies comprising the Wahoo. Aspects of rock units adjacent to the Wahoo, the underlying Endicott Group and Alapah Limestone and overlying Echooka Formation are also discussed. This report includes an overview of the regional geological framework; a discussion of biostratigraphic results; a summary of diagenetic studies; and preliminary results of comparative studies of a cored well in the Lisburne oil field. A computerized database system (the Wahoo database) was developed and is explained in a users manual. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

20602 (DOE/BC/14897–6) **Anisotropy and spatial variation of relative permeability and lithologic character of Tensleep Sandstone reservoirs in the Bighorn and Wind River basins, Wyoming. Annual report, September 15, 1993–September 30, 1994.** Dunn, T.L. Wyoming Univ., Laramie, WY (United States). Jul 1995. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14897. Order Number DE95000156. Source: OSTI; NTIS; GPO Dep.

The principal focus of this project is to evaluate the importance of relative permeability anisotropy with respect to other known geologic and engineering production concepts. This research is to provide improved strategies for enhanced oil recovery from the Tensleep Sandstone oil reservoirs in the Bighorn and Wind River basins, Wyoming. The Tensleep Sandstone contains the largest potential reserves within reservoirs which are candidates for EOR processes in the State of Wyoming. Although this formation has produced billions of barrels of oil, in some fields, as little as one in seven barrels of discovered oil is recoverable by current primary and secondary techniques. Because of the great range of °API gravities of the oils produced from the Tensleep Sandstone reservoirs, the proposed study concentrates on establishing an understanding of the spatial variation and anisotropy of relative permeability within the Tensleep Sandstone. This research is to associate those spatial distributions and anisotropies with the depositional subfacies and zones of diagenetic alteration found within the Tensleep Sandstone. In addition, these studies are being coupled with geochemical modeling and coreflood experiments to investigate the potential for wellbore scaling and formation damage anticipated during EOR processes (e.g., CO_2 flooding). This multidisciplinary project will provide a regional basis for EOR strategies which can be clearly mapped and efficiently applied to the largest potential target reservoir in the State of Wyoming. Additionally, the results of this study have application to all eolian reservoirs

through the correlations of relative permeability variation and anisotropy with eolian depositional lithofacies.

20603 (DOE/ER/14081–T4) **Models of natural fracture connectivity: Implications for reservoir permeability. Annual report for DOE Basic Energy Sciences, 1990.** Pollard, D.D. (Stanford Univ., CA (United States). Dept. of Applied Earth Sciences); Aydin, A. Stanford Univ., CA (United States). Dept. of Applied Earth Sciences. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER14081. Order Number DE95012911. Source: OSTI; NTIS; GPO Dep.

Fluid flow through fracture networks in a rock mass depends strongly on the nature of connections between fracture segments and between individual fractures. Therefore the objective of this research project is to develop three dimensional models for natural fracture connectivity using an integrated field, laboratory, and theoretical methodology. The geometric models we have developed are based on detailed field mapping and observations from outcrops of both massive and layered sedimentary rocks, typical of producing oil and gas reservoirs, or of aquifers. Furthermore, we have used computer simulations and laboratory experiments to investigate the physical mechanisms responsible for fracture connectivity (or lack thereof) as single and multiple sets of fractures evolve. The computer models are based on fracture mechanics principles and the laboratory experiments utilize layered composite materials analogous to sedimentary sequences. By identifying the physical mechanisms of connectivity we can relate the degree of connectivity to the geometry, state of stress, and material properties of the reservoir rocks and, in turn, be in a position to evaluate the influence of these factors on fracture permeability.

20604 (DOE/ER/14081–T5) **Models of natural fracture connectivity: Implications for Reservoir permeability. Final report for DOE Basic Energy Sciences, 1992.** Pollard, D.D.; Aydin, A. Stanford Univ., CA (United States). Dept. of Applied Earth Sciences. [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER14081. Order Number DE95012910. Source: OSTI; NTIS; GPO Dep.

Fluid flow through fracture networks in a rock mass de ends strongly on the nature of connections between fracture segments and between individual fractures. Therefore the objective of this research project is to develop three dimensional models for natural fracture connectivity using an integrated field, laboratory, and theoretical methodology. The geometric models we have developed are based on detailed field mapping and observations from outcrops of both massive and layered sedimentary rocks, typical of producing oil and gas reservoirs, or of aquifers. Furthermore, we have used computer simulations and laboratory experiments to investigate the physical mechanisms responsible for fracture connectivity (or lack thereof) as single and multiple sets of fractures evolve. The computer models are based on fracture mechanics principles and the laboratory experiments utilize layered composite materials analogous to sedimentary sequences. By identifying the physical mechanisms of connectivity we can relate the degree of connectivity to the geometry, state of stress, and material properties of the reservoir rocks and, in turn, be in a position to evaluate the influence of these factors on fracture permeability.

20605 (DOE/MC/29078–95/C0469) **Atlas of Northern Gulf of Mexico Gas and Oil Reservoirs: Procedures and examples of resource distribution.** Seni, S.J.; Finley, R.J. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI21-92MC29078. (CONF-950494–23: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012999. Source: OSTI; NTIS; GPO Dep.

The objective of the program is to produce a reservoir atlas series of the Gulf of Mexico that (1) classifies and groups offshore oil and gas reservoirs into a series of geologically defined reservoir plays, (2) compiles comprehensive reservoir play information that includes descriptive and quantitative summaries of play characteristics, cumulative production, reserves, original oil and gas in place, and various other engineering and geologic data, (3) provides detailed summaries of representative type reservoirs for each play, and (4) organizes computerized tables of reservoir engineering data into a geographic information system (GIS). The primary product of the program will be an oil and gas atlas series of the offshore Northern Gulf of Mexico and a computerized geographical information system of geologic and engineering data linked to reservoir location.

20606 (ETDE/JP-mf–95786711) **Record of TRC's activities in the fiscal year 1993. Geology and geochemistry laboratory.** Japan National Oil Corp., Tokyo (Japan). 31 Oct 1994. 171p. (In Japanese). Order Number DE95786711. Source: OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan.

Technology Research Center belongs to Japan National Oil Corporation, and it is in various activities as a core organ for petroleum development and engineering in Japan. This record is the report of its Geology and Geochemistry Laboratory in fiscal 1993. The outline of the history, facilities, etc., of the Center have been explained in the beginning, and the contents of researches and the various reports of the result in fiscal 1993 have been compiled in the record. For the purpose of developing and improving the technology of prospecting mainly with geology and geochemistry fields, the studies of the following five subjects have continued: 'Tectonic history of sedimentary basins' and 'Basic study on geophysical logging' as the basic R and D; and 'Techniques for interpretation and reconstruction of reservoir development', 'Simulation for integration of generation, migration and accumulation of petroleum' and 'Surface geochemical prospecting' as the applicable R and D. The reports of the 17 subtitles have also been printed. In addition, a 'List of R and D results' has been included such as technical papers published and presented at technical societies; and summarized reports have been printed on various activities such as technology transfer, technical services concerning publication and public information, education and training, and international R and D cooperation. 7 refs., 120 figs., 19 tabs.

20607 (ETDE/JP-mf–95786715) **Record of TRC's activities in the fiscal year 1993. Geophysical Laboratory.** Japan National Oil Corp., Tokyo (Japan). 31 Oct 1994. 164p. (In Japanese). Order Number DE95786715. Source: OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan.

Technology Research Center belongs to Japan National Oil Corporation, and it is in various activities as a core organ for petroleum development and engineering in Japan. This record is the report of its Geophysics Laboratory in fiscal 1993. The outline of the history, facilities, etc., of the Center has been explained in the beginning, and the contents of researches and the various reports of the result in fiscal 1993 have been compiled in the record. For the purpose of improving the accuracy of geophysical method and developing new technology, the researches for fiscal 1993 was carried out under five subjects, which were, as the basic R and D, 'Basic research on petrophysical evaluation of rock properties' and 'Application of advanced information technologies to geophysical exploration'; as the applicable R and D, 'Geophysics in difficult problem areas', and 'Geophysical reservoir characterization'; and, as the collaborative R and D with private companies, 'Advanced seismic imaging technology'. Under these subjects, 21 subtitles have also been reported. In addition, a 'List of R and D results' has been included such as technical papers published and presented at technical societies; and summarized reports have been printed for various activities such as technology transfer, technical services concerning publication and public information, education and training, and international R and D cooperation. 18 refs., 127 figs., 25 tabs.

20608 (ETDE/JP-mf–95786721) **Record of TRC's activities in the fiscal year 1993. Reservoir engineering laboratory.** Japan National Oil Corp., Tokyo (Japan). 31 Oct 1994. 105p. (In Japanese). Order Number DE95786721. Source: OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan.

Technology Research Center (TRC) belongs to Oil Development Corporation and undertakes various activities as the central organization in the field of oil development technology. This report is the annual record of its Reservoir Engineering Laboratory for fiscal 1993 covering the history of the center, the outline of its research

facilities, and then the studies accomplished in fiscal 1993, and the contents and results of said studies. In progress are experiments centering about improvement on the rate of recovery of crude oil and gas from the reservoir and on the adoption and buildup of various software for analyzing equipment and evaluation. Received in fiscal 1993 were 13 research reports including a Routine R and D Theme study 'Development of Reservoir Simulation Models', Main R and D Themes studies 'Advanced Reservoir Evaluation Technology' and 'Horizontal Well Technology', and a special study 'Research on the Improvement of Productivity for Tight Carbonate Reservoir'. As the results, image processing equipment and automatic permeability and pore rate measuring equipment were introduced, software related to oil reservoir simulation and others was developed, and on-the-scene experiments were conducted for the verification of well bottom pressure measuring equipment. 5 refs., 62 figs., 15 tabs.

20609 (NEI-DK–2064) **Status report Nov. 1993 of adsorption of hydrocarbons in chalk reservoirs.** Madsen, L. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Geologi og Geoteknik; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Mineralindustri. 1993. 53p. Contract ENS-1313/93-0005. Order Number DE95787834. Source: OSTI; NTIS.

EFP-93.

The wettability of calcite is important to the optimization of oil and gas production from chalk reservoirs. The resulting description of the adsorption properties of calcite in chalk reservoirs involved surveying relevant literature and conducting adsorption experiments on selected calcite/water systems using the batch method. A clear description of the calcite surface is not possible using electrokinetic measurements. Recently the adsorption of aromatic hydrocarbons onto synthetic calcite ($CaCO_3$) and αalumina (α-Al_2O_3) form an organic phase was investigated, using the batch method, also the adsorption of aromatic hydrocarbons onto α-alumina and boehmite (γ-AlOOH) from the aqueous phase. These investigations demonstrated that the adsorption properties of the powders could be accurately characterized under the given conditions. It is concluded that (on the basis of the preliminary experiments) adsorption of the negatively charged benzoate, molecule can not take place because Ca^{++} ions present in the bulk solution result in a complex formation according to: $2R\text{-}COO^- + Ca^{++}$ $(R\text{-}COO)_2Ca_{(aq)}$. There is a marked difference between the adsorption capacity of benzoic acid in the aqueous and organic phase, and saturated fatty acid of long chain hydrocarbons behaves differently from the aromatic acid in a calcite/water system. From the literature study it is concluded that the widely differing published results concerning the zeta potential of calcite in aqueous solutions can be explained by variation in the experimental conditions: pH, equilibration time, pCO_2 variations (open/closed systems), composition of electrolyte medium, and the nature of calcite. This not only gives the possibility of conducting adsorption experiments form the aqueous phase, but also shows the relevance of conducting experiments controlling the ruling factors. (AB) 32 refs.

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Refer also to citation(s) 20602, 20658, 20702, 21398, 21700

20610 (DOE/BC/14652–15) **Dispersion measurement as a method of quantifying geologic characterization and defining reservoir heterogeneity. Final report.** Menzie, D.E. Oklahoma Univ., Norman, OK (United States). May 1995. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14652. Order Number DE95000141. Source: OSTI; NTIS; GPO Dep.

The main objective of this research project is to investigate dispersion as a method of quantifying geological characterization and defining reservoir heterogeneity in order to enhance crude oil recovery. The dispersion of flow of a reservoir rock (dispersion coefficient and dispersivity) was identified as one of the physical properties of a reservoir rock by measuring the mixing of two miscible fluids, one displacing the other in a porous medium. A rock was 100% saturated with a resident fluid and displaced by a miscible fluid of equal viscosity and equal density. Some specific experiments were performed with unequal densities. Produced fluid was analyzed by refractometer, nuclear reaction, electrical conductivity and X-ray scan. Several physical and flow characteristics were measured on the sand rock sample in order to establish correlations with the measured dispersion property. Absolute permeability, effective porosity, relative permeability, capillary pressure, the heterogeneity factor and electrical conductivity were used to better understand the flow system. Linear, transverse, 2-D and 3-D dispersions were measured and used to characterize the rock heterogeneity of the flow system. A new system of measuring dispersion was developed using a gas displacing gas system in a porous medium. An attempt was also made to determine the dispersion property of an actual reservoir from present day well log data on a producing well. 275 refs., 102 figs., 17 tabs.

20611 (DOE/BC/14852–12) **Scale-up of miscible flood processes for heterogeneous reservoirs. Quarterly report, January 1–March 31, 1995.** Orr, F.M. Jr. Stanford Univ., CA (United States). Dept. of Petroleum Engineering. Apr 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92BC14852. Order Number DE95012151. Source: OSTI; NTIS; GPO Dep.

The current project is a systematic research effort aimed at quantifying relationships between process mechanisms that can lead to improved recovery from gas injection processes performed in heterogeneous Class 1 and Class 2 reservoirs. It will provide a rational basis for the design of displacement processes that take advantage of crossflow due to capillary, gravity and viscous forces to offset partially the adverse effects of heterogeneity. In effect, the high permeability zones are used to deliver fluid by crossflow to zones that would otherwise be flooded only very slowly. Thus, the research effort is divided into five areas: development of miscibility in multicomponent systems; design estimates for nearly miscible displacements; design of miscible floods for fractured reservoirs; compositional flow visualization experiments and simulation of near-miscible flow in heterogeneous systems. The status of the research effort in each area is reviewed briefly. In addition, results from pore-level modelling of three-phase flow in porous media are presented.

20612 (DOE/BC/14883–11) **Surfactant-enhanced alkaline flooding for light oil recovery. Quarterly report, October 1–December 30, 1994.** Wasan, D.T. Illinois Inst. of Tech., Chicago, IL (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14883. Order Number DE95012165. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a very cost-effective method for formulating a successful surfactant-enhanced alkaline flood by appropriately choosing mixed alkalis which form inexpensive buffers to obtain the desired pH (between 8.5 and 12.0) for ultimate spontaneous emulsification and ultra-low tension. In addition, the novel concept of pH gradient design to optimize flood water conditions will be tested. The problem of characterizing emulsions in porous media is very important in enhanced oil recovery applications. This is usually accomplished by externally added or insitu generated surfactants that sweep the oil out of the reservoir. Emulsification of the trapped oil is one of the mechanisms of recovery. The ability to detect emulsions in the porous medium is therefore crucial to designing profitable flood systems. The capability of microwave dielectric techniques to detect emulsions in porous medium is demonstrated by mathematical modelling and by experiments. This quarter the dielectric properties of porous media are shown to be predicted adequately by treating it an an O/W type dispersion of sand grains in water. Dielectric measurements of emulsion flow in porous media show that dielectric techniques may be applied to determine emulsion characteristics in porous media. The experimental observations were confirmed by theoretical analysis.

20613 (DOE/BC/14886–11) **Investigation of oil recovery improvement by coupling an interfacial tension agent and a mobility control agent in light oil reservoirs. Technical progress report, January–March 1995.** Pitts, M.J. Surtek, Inc., Golden, CO (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14886. Order Number DE95012148. Source: OSTI; NTIS; GPO Dep.

Two series of corefloods were performed to improve alkaline-surfactant-polymer oil recovery economics. In these series of corefloods, the objective was to increase oil recovery by changing the chemical injection sequence. An alkaline gradient was evaluated in the first series of corefloods. Radial corefloods using Berea core were performed in which a pre-flush of alkaline-polymer solution was injected before the alkaline-surfactant-polymer solution. 30% pore volume (PV) of 1.0 wt % Na_2CO_3 plus 0.2 wt % Petrostep B-100 plus 500 mg/l Flopaam 3330S was injected followed by 30% PV 500 mg/l Flopaam 3330S. A 5% PV 2.0 wt % Na_2CO_3 plus 500 mg/l Flopaam 3330S followed by 5% PV 1.5 wt % Na_2CO_3 plus 500 mg/l Flopaam 3330S was injected prior to the alkaline-surfactant-polymer solution in the coreflood with an alkaline-polymer pre-flush. A water flush of 1.5 to 2 PV followed chemical injection. The pre-flush objective was to inject sufficient alkali to satiate consumption and to force the surfactant to go through optimum interfacial tension and phase behavior states. Incremental oil recovery increased 24% from 0.106 PV (30.3% waterflood residual oil) to 0.131 PV (38.6% waterflood residual oil) when an alkaline-gradient pre-flush was injected. The effect on the oil recovery economics of an alkaline-polymer pre-flush is shown in Table 2. Oil recovery as well as the mass of alkali and polymer injected increased making the cost per incremental barrel of oil unchanged.

20614 (DOE/BC/14893–6) **Integration of advanced geoscience and engineering techniques to quantify interwell heterogeneity in reservoir models. First annual report, September 29, 1993–September 30, 1994.** Martin, F.D.; Buckley, J.S.; Weiss, W.W.; Ouenes, A. New Mexico Petroleum Recovery Research Center, Socorro, NM (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14893. Order Number DE95000147. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to provide a more quantitative definition of reservoir heterogeneity. This objective will be accomplished through the integration of geologic, geophysical, and engineering databases into a multidisciplinary understanding of reservoir architecture and associated fluid-rock and fluid-fluid interactions. The intent is to obtain a quantitative reservoir description incorporating outcrop, field, well-to-well, and laboratory core and fluid data of widely varying scales. This interdisciplinary effort will integrate geological and geophysical data with engineering and petrophysical results through reservoir simulation to quantify reservoir architecture and the dynamics of fluid-rock and fluid-fluid interactions. A more accurate reservoir description will allow greater accuracy and confidence during simulation and modeling as steps toward gaining greater recovery efficiency from existing reservoirs. A field laboratory, the Sulimar Queen Unit, is available for the field research activities that will be conducted.

20615 (DOE/BC/14951–10) **Integrated approach towards the application of horizontal wells to improve waterflooding performance. Annual report.** Kelkar, M.; Liner, C.; Kerr, D. Tulsa Univ., OK (United States). May 1995. 137p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14951. Order Number DE95000146. Source: OSTI; NTIS; GPO Dep.

This annual report describes the progress during the second year of the project on Integrated Approach Towards the Application of Horizontal Wells to Improve Waterflooding Performance. This project is funded under the Department of Energy's Class I program which is targeted towards improving the reservoir performance of mature oil fields located in fluvial-dominated deltaic deposits. The project involves an integrated approach to characterize the reservoir followed by the drilling of horizontal injection wells to improve production performance. The type of data we have integrated include cross bore hole seismic surveys, geological interpretation based on logs and cores, and engineering information. This report covers the second phase of the project which includes a detailed reservoir description of the field by integrating all the available information, followed by flow simulation of the Self Unit under various operating conditions. Based on an examination of the various operating parameters, we observed that the best possible solution to improve the Self Unit performance is to recomplete and stimulate most of the wells followed by an increase in the water injection rate. Drilling of horizontal injection well, although helpful in improving the performance, was not found to be economically feasible. The proposed reservoir management plan will be implemented shortly.

20616 (DOE/BC/14954–10) **Improved secondary recovery demonstration for the Sooner Unit. Quarterly technical report, January 1, 1995–March 31, 1995.** Diversified Operating Corp., New Raymer, CO (United States). 8 May 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14954. Order Number DE95012547. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to demonstrate the effectiveness of geologically targeted infill drilling and improved reservoir management to obtain maximum oil recovery from the Sooner Unit in the Denver-Julesburg (D-J) Basin. The Sooner Unit Field is located about 100 miles northeast from Denver, Colorado and produces from the fluvial-deltaic Cretaceous "D" Sand formation at an average depth of 6,200 ft. The first phase of the project will involve multi-disciplinary reservoir characterization and recovery identification in which high-density 3-D seismic. detailed stratigraphy and engineering analysis will be used to identify optimum infill well sites and production/withdrawal schedules. One well will be drilled during this phase to obtain data pertinent to seismic activities. The second phase will involve implementation of the selected technologies by drilling geologically targeted infill wells and establishing production/injection schedules. Evaluation of results from the second phase will be performed using reservoir simulation. transient well tests and careful production tests of producing wells. The objective will be to compare the prediction of ultimate recovery resulting from the implementation of these technologies with that which would have occurred in the absence of these technologies. The third phase of the project will involve technology transfer through a series of technical papers and presentations of a short course. Emphasis will be on the economics of the project and implemented technologies. Small to medium sized independents will be targeted. The success of this project and effective technology transfer should prompt-reappraisal of older waterflood projects and implementation of new projects in oil provinces such as the D-J Basin.

20617 (DOE/BC/14955–8) **Applications of advanced petroleum production technology and water alternating gas injection for enhanced oil recovery - Mattoon Oil Field, Illinois. Final report.** Baroni, M. (American Oil Recovery, Inc., Decatur, IL (United States)); Baroni, J.J.; Blake, D.; Miller, B. American Oil Recovery, Inc., Decatur, IL (United States). Mar 1995. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14955. Order Number DE95012158. Source: OSTI; NTIS; GPO Dep.

Phase I results of a $C0_2$-assisted oil recovery demonstration project in selected Cypress Sandstone reservoirs at Mattoon Field, Illinois are reported. The design and scope of this project included $C0_2$ injectvity testing in the Pinnell and Sawyer units, well stimulaton treatments with $C0_2$ in the Strong unit and infill well drilling, completion and oil production. The field activities were supported by extensive $C0_2$-oil-water coreflood experiments, CO_2 oil-phase interaction experiments, and integrated geologic modeling and reservoir simulations. The progress of the project was made public through presentations at an industry meeting and a DOEs contractors' symposium, through quarterly reports and one-to-one consultations with interested operators. Phase II of this project was not implemented. It would have been a water-alternating-gas (WAG) project of longer duration.

20618 (DOE/BC–14958-10) **Green River formation water flood demonstration project, Unita Basin, Utah. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Lomax, J.D.; Nielson, D.L.; Deo, M.D. Lomax Exploration Co., Denver, CO (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14958. Order Number DE95012548. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to understand the successful water flood in the Monument Butte unit and apply it to other units and other reservoirs. Expanding the Monument Butte Water Flood was also one of the objectives. This report provides progress in the areas of field drilling and production results and modeling the boundary unit.

20619 (DOE/BC–14977-4) **Improved efficiency of miscible CO_2 floods and enhanced prospects for CO_2 flooding heterogeneous reservoirs. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Grigg, R.B.; Heller, J.P.; Schechter, D.S. New Mexico Petroleum Recovery Research Center, Socorro, NM (United States). 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94BC14977. Order Number DE95012549. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to improve the effectiveness of CO_2 flooding in heterogeneous reservoirs. Activities include: exploration of the applicability of selective mobility reduction utilizing foams; possible higher economic viability of floods at slightly reduced CO_2 injection pressures; and taking advantage of gravitational forces during flooding in fractured reservoirs.

20620 (DOE/BC/14983–4) **Recovery of bypassed oil in the Dundee formation using horizontal drains. Second quarterly report, [January–March 1995].** Wood, J.R. Michigan Technological Univ., Houghton, MI (United States). 15 Apr 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14983. Order Number DE95012157. Source: OSTI; NTIS; GPO Dep.

Well data, including drillers' logs, wireline logs, and seismic data, from the Crystal and 3 0 other Dundee oil fields in the Michigan basin have been acquired. Digitized logs of 336 wells that currently produce or have produced from the Dundee Formation in the seven-county study area have been purchased from Maness Petroleum Company. The data-gathering phase of the well-log program is now complete. Well-log analysis using TerraSciences TerraStation software has begun. Detailed analyses of wells with modern logs are being made using density/porosity and Pickett crossplots. Water saturations were calculated for several wells in the past month. Production data have been added to the well-file database. We now have the capability of mapping production as well as geology. Well-location basemaps with permit numbers were constructed for all 30 fields. Contour maps were completed for all 30 fields during the last quarter, including maps: on the top of the Dundee Formation, the top of the Dundee porosity zone (which is well below the top of the Dundee and varies in stratigraphic position throughout most fields), Dundee to Traverse isopachs, and initial production values before and after well treatment. At least two simple computer-generated cross sections were constructed for each field.

20621 (DOE/BC/14984–3) **Improved recovery demonstration for Williston Basin carbonates. Quarterly report, January 1, 1995–March 31, 1995.** Carrell, L.A.; Nautiyal, C. Luff Exploration Co., Denver, CO (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14984. Order Number DE95012156. Source: OSTI; NTIS; GPO Dep.

The purpose of this project is to demonstrate targeted infill and extension drilling opportunities, better determinations of oil-in-place, methods for improved completion efficiency and the suitability of waterflooding in certain shallow-shelf carbonate reservoirs in the Williston Basin, Montana, North Dakota and South Dakota. Cores from five Red River wells in the Bowman-Harding study area have been examined and described in detail; contracts have been awarded for a 3-D survey in Bowman Co., ND and a 2D, multicomponent survey in Richland Co.; extended-time pressure buildup data have been analyzed from two wells which are candidates for jetting-lance completion workovers; a 20-day injectivity test has been completed in the Red River (upper member); a jetting-lance completion program has commenced with one job completed and three more scheduled during April; and reservoir data from three key Red River fields in the Bowman-Harding study area has been researched and accumulated for inclusion in the TORIS database and technology transfer activities.

20622 (DOE/BC/14986–3) **CO_2 Huff-n-Puff process in a light oil shallow shelf carbonate reservoir. 1994 Annual report.** Wehner, S.C. Texaco Exploration and Production, Inc., Midland, TX (United States). May 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14986. Order Number DE95000142. Source: OSTI; NTIS; GPO Dep.

It is anticipated that this project will show that the application of the CO_2 Huff-n-Puff process in shallow shelf carbonates can be economically implemented to recover appreciable volumes of light oil. The goals of the project are the development of guidelines for cost-effective selection of candidate reservoirs and wells, along with estimating recovery potential. The selected site for the demonstration project is the Central Vacuum Unit waterflood in Lea County, New Mexico. Work is nearing completion on the reservoir characterization components of the project. The near-term emphasis is to, (1) provide an accurate distribution of original oil-in-place on a waterflood pattern entity level, (2) evaluate past recovery efficiencies, (3) perform parametric simulations, and (4) forecast performance for a site specific field demonstration of the proposed technology. Macro zonation now exists throughout the study area and cross-sections are available. The Oil-Water Contact has been defined. Laboratory capillary pressure data was used to define the initial water saturations within the pay horizon. The reservoir's porosity distribution has been enhanced with the assistance of geostatistical software. Three-Dimensional kriging created the spatial distributions of porosity at interwell locations. Artificial intelligence software was utilized to relate core permeability to core porosity, which in turn was applied to the 3-D geostatistical porosity gridding. An Equation-of-State has been developed and refined for upcoming compositional simulation exercises. Options for local grid-refinement in the model are under consideration. These tasks will be completed by mid-1995, prior to initiating the field demonstrations in the second budget period.

20623 (DOE/BC/14986–4) **CO_2 HUFF-n-PUFF process in a light oil shallow shelf carbonate reservoir. Quarterly technical progress report, [January 1, 1995–March 31, 1995].** Cole, R.; Prieditis, J.; Vogt, J.; Wehner, S. Texaco Exploration and Production, Inc., Midland, TX (United States). 21 Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14986. Order Number DE95012155. Source: OSTI; NTIS; GPO Dep.

The principal objective of the Central Vacuum Unit (CVU) CO_2 Huff-n-Puff (H-n-P) project is to determine the feasibility and practicality of the technology in a waterflooded shallow shelf carbonate environment. The results of parametric simulation of the CO_2 H-n-P process, coupled with the CVU reservoir characterization components will determine if this process is technically and economically feasible for field implementation. The technology transfer objective of the project is to disseminate the knowledge gained through an innovative plan in support of the Department of Energy's (DOE) objective of increasing domestic oil production and deferring the abandonment of shallow shelf carbonate (SSC) reservoirs. Technical progress is reported for geostatitical realizations; paramatric simulation; waterflood review; and reservoir characterization.

20624 (DOE/BC/14991–3) **Design and implementation of a CO_2 flood utilizing advanced reservoir characterization and horizontal injection wells in a shallow shelf carbonate approaching waterflood depletion: Project management/ evaluation plan.** Hallenbeck, L.D.; Harpole, K.J.; Gerard, M.G. Phillips Petroleum Co., Bartlesville, OK (United States). 3 May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14991. Order Number DE95012186. Source: OSTI; NTIS; GPO Dep.

The objectives of the Management/Evaluation Plan are: (1) clarify management structure, task responsibilities and schedules, and (2) to be used as a basis for judging the Project Evaluation Report submitted as a part of the continuation application. The components addressed in the report are: management structure; project staff organization; management procedure; quality assurance plan; ES and H plan and environmental compliance reporting; task WBS and logic flow diagram; list and schedule of planned deliverables; diagram of existing facilities; industry interaction; and evaluation of technical and economic feasibility.

20625 (DOE/BC–95000144) **Reservoir characterization and process monitoring with EM methods. 1994 Annual report.** Wilt, M. Lawrence Livermore National Lab., CA (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95000144. Source: OSTI; NTIS; GPO; GPO Dep.

During the past five years at Lawrence Livermore National Laboratory (LLNL) the authors have applied the EM induction method to the problem of petroleum reservoir characterization and enhanced oil recovery (EOR) monitoring. The goal is to develop practical tools for determining the electrical resistivity distribution between boreholes at a useful scale for reservoir characterization. During FY94 the authors conducted their largest field test to date. They applied crosshole and surface-to-borehole EM techniques to reservoir characterization at the Los Hills No. 3 oil field making three sets of measurements during the initial phase of the steam drive.From these data they were able to determine the resistivity and configuration of the oil sands, between the observation wells, and provide an image of the subsurface resistivity changes due to the steam drive. They also conducted a waterflood experiment at the Richmond Field Station facility using the borehole-to-surface EM technique. For this test they injected a small quantity of saltwater, and applied the Em technique to monitor the progress of the injected plume. Data collection for this experiment is complete but the results are yet to be interpreted. Finally, a project to understand EM propagation through steel casing was initiated in 1994. The goals of the experiment are to determine the limits and applications for crosswell EM surveys through steel well casing.

20626 (DOE/MC/29252–3954) **Development of a near-bit MWD system. Quarterly report, April 1994–June 1994.** McDonald, W.J.; Pittard, G.T. Maurer Engineering, Inc., Houston, TX (United States). Nov 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC29252. Order Number DE95000045. Source: OSTI; NTIS; GPO Dep.

Horizontal drilling utilized in the oil and gas fields has need of accurate directional placement and drilling conditions at the bit. The preliminary design of a drill bit with a measuring instrument/ telemetry system attached is briefly described.

20627 (ETDE-DE–128) **Multiple phase flow in transition zones occuring in porous media.** Meyn, V.; Hollerbach, A. Institut fuer Erdoelforschung, Clausthal-Zellerfeld (Germany). 1993. 12p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0326595A; Contract EN 3C-0049-D. Order Number DE95780311. Source: OSTI; NTIS (US Sales Only).

The displacement behaviour of carbon dioxid/oil-systems is not only governed by thermodynamical properties of the related phases, but also by the transport behaviour of compounds involved. In contradiction to the results of the theory of multicomponent chromatography not including dispersion, the dispersion results in a continuous change of the concentration of all components. This is valid below and above MMP. Especially the prevention of the separation of methane, ethane and carbon dioxide results in an elongation of the composition path within the homogeneous region of the transition zone. The cross-over into the large methane/oil miscibility gap is avoided, which would lead to an unstable immiscible gas drive at high viscosity- and density differences. The miscibility gap is entered at high CO_2-concentrations resulting in minor interfacial tension in front of the transition zone. (orig.)

20628 (ETDE/JP-mf–95786726) **Record of TRC's activities in the fiscal year 1993. Enhanced recovery laboratory.** Japan National Oil Corp., Tokyo (Japan). 31 Oct 1994. 111p. (In Japanese). Order Number DE95786726. Source: OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan.

This is the fiscal 1993 report of Enhanced Recovery Laboratory, in which the history of the center, the outline of the facilities, etc., are stated, and then a report is made about the contents and the results of its researches for fiscal 1993. The laboratory aims at an increased oil recovery rate and at the establishment of enhanced oil recovery (EOR) technology, and, in fiscal 1993, submitted 8 reports under three main themes. In 'Microbial EOR Technology', useful microbes are searched for and oil recovery experiments are conducted using them, in 'Heavy Oil EOR Technology', in addition to field tests at the Ikiztepe oil field, studies related to steam flood and CO2 gas flood are discussed, and, in 'Enhanced Oil Recovery', studies are made in relation to CO2 gas floods and chemical floods that were conducted in Niigata and Akita Prefectures. This report also carries a list of research results, and various activities such as technical service, training and education and international cooperation. 73 figs., 29 tabs.

20629 (ETDE/JP-mf–95786730) **Record of TRC's activities in the fiscal year 1993. Petroleum engineering laboratory.** Japan National Oil Corp., Tokyo (Japan). 31 Oct 1994. 160p. (In Japanese). Order Number DE95786730. Source: OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan.

This is the fiscal 1993 annual report that covers Petroleum Engineering Laboratory activities. The laboratory undertakes research and development aiming at cost reduction and operating safety in the technological field related to digging, production, marine exploitation for the production of petroleum and gas. Taken up as typical basic researches in fiscal 1993 are 'Basic Research on Drilling Technology', 'Basic Research on Production Technology', 'Horizontal Well Technology', 'Development of Small Scale Offshore LNG Plant', 'EM-MWD Technology', 'Technologies for Offshore Marginal Oil Field Development', 'Production Technology under High-Temperature and Corrosive Environments', 'Direct Conversion of Natural Gas to Liquid Fuel', and 'Basic Research for Oil Development Technologies in the Arctic Regions'. Sub-themes as many as 23 are also reported in line with the said themes. In addition, a list of the results of researches (papers and patents) and technical service activities are reported. 120 figs., 38 tabs.

20630 (NIPER/BDM–0086, pp. 3-8) **Redeeming features of in situ combustion.** Farouq Ali, S.M. (Univ. of Alberta, Edmonton (Canada)). BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

In situ combustion remains the most tantalizing enhanced oil recovery method. It has been tested extensively - in over 150 field tests - in both heavy and light oil reservoirs. What we have learned from this experience is that in situ combustion works under most conditions, but the nature of the problems is such that it is seldom profitable. Also, looking at many previous in situ combustion tests, steam injection, and even waterflooding, would have been a better choice. Yet in situ combustion has unique features not found in any other EOR method. These must be weighed against its shortcomings to evaluate a potential application. This paper discusses the redeeming features of in situ combustion, in particular the reservoir conditions under which in situ combustion may be superior to other EOR methods are outlined. All variations of in situ combustion - forward, reverse, wet, dry - as well as combinations with other EOR methods are considered. The conclusions is that in situ combustion still has a place, and its future application would depend on research on certain crucial aspects of the process.

20631 (NIPER/BDM–0086, pp. 9-13) **Oxygen enriched fireflooding.** Shahani, G.H. (Air Products and Chemicals, Allentown, PA (United States)); Gunardson, H.H. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Both pure oxygen and enriched air have been considered in fireflooding for enhanced oil recovery. Laboratory and field testing have conclusively shown that oxygen is practical and cost effective for this application. For reservoirs that require a large volume of high pressure gas, oxygen is cheaper than air simply based on compression costs. Additional process benefits with oxygen include: Faster Oil Production; Lower Injection Pressure; Greater Well Spacing; Increased Carbon Dioxide Partial Pressure; Lower Gas-to-Oil Ratios; and Purer Produced Gas. These features provide a compelling case for oxygen, once the safety and materials compatibility issues are properly addressed.

20632 (NIPER/BDM–0086, pp. 15-39) **In situ combustion - from pilot to commercial application.** Turta, A. (Petroleum Recovery Institute, Alberta (Canada)). BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

In 1994, there are at least 14 active commercial in-situ combustion (ISC) projects worldwide. A review of these projects is carried out in order to emphasize the important factors which contributed to the success of the processes. The success of the developing an ISC pilot into a commercial ISC project is strongly connected with two factors: (a) starting the operation from the uppermost part of the structure and extending the process downwards and (b) application of the line drive well configuration instead of patterns, whenever is possible. An effective, peripheral line drive operation requires pool utilization. The most challenging phase towards commercialization of an ISC project is the field pilot design, implementation and evaluation. This paper is focused on the advantages of locating ISC pilot at the upper zone of the reservoir, due to the need for a full scale integration of the pilot with the subsequent semi- and commercial development of the process.

20633 (NIPER/BDM–0086, pp. 41-64) **DOE cost-shared in situ combustion projects revisited.** Sarathi, P.S. (NIPER/BDM-Oklahoma, Bartlesville, OK (United States)); Olsen, D.K. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. DOE Contract AC22-94PC91008. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

As part of its enhanced oil recovery (EOR) program, the US Department of Energy (DOE) and its predecessor organizations sponsored several cost-shared in situ combustion projects in the 1960s and 1970s. The goal of these projects was to evaluate the technical and economic feasibility of in situ combustion as a thermal oil recovery technique and provide information in the public domain as a means of reducing the risks associated with these high cost ventures. This study reviewed specific features of the cost-shared demonstration and experimental projects, and examined the causes that led to their success or failure. The failed projects were compared with the successful projects under similar settings to further document why these projects failed. The lessons learned were detailed.

20634 (NIPER/BDM–0086, pp. 65-81) **In situ combustion field experiences in Venezuela.** Villalba, M. (INTEVEP, Caracas (Venezuela)); Estrada, M.; Bolivar, J. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

A literature review of four in situ combustion projects: in Miga, Tia Juana, Melones and Morichal fields in Venezuela was made, and a summary of these projects is presented. Reservoir description and project performance data were analyzed. The behavior of the four in situ combustion field tests can be summarized as follows: The problems most often encountered were corrosion and high temperature producing wells. The direction in which the burning front moved was guided essentially by reservoir characteristics. The produced oil was upgraded by about 4° API, and viscosity was substantially reduced. For Mirochal and Miga fields, the analyses of available information from the combustion projects indicated that the process has been successful in the affected region. Conclusions from this review indicate that the two most frequent problems encountered were operational problems in producing wells and the direction of the burning front. The heterogeneous nature of the sands probably resulted in the burning front moving in a preferential direction, hence reducing areal sweep efficiency.

20635 (NIPER/BDM–0086, pp. 83-96) **Romania - 30 years of experience in in situ combustion.** Machedon, V. (Research and Design Institute for Oil and Gas, Cimpina (Romania)); Popescu, T.; Paduraru, R. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Starting with 1963, simultaneous pilot and semi-commercial steam flooding and in situ combustion tests were carried out at Suplacu de Barcau heavy oil field (16° API). The performance of in situ combustion was by far better and as a result, the entire reservoir was designed to produce by this method, by abandoning the "patterns" concept and introducing the "continuous front" concept. Under primary production, the ultimate recovery factor would have been 9.2%, while an ultimate recovery factor of at least 50% is expected by in situ combustion. In situ combustion was applied on three other major reservoirs: Balaria in 1975, East Videle in 1979, and West Videle in 1980. For those reservoirs, as compared to the average ultimate recovery of about 10% under primary production, an average ultimate recovery of at least 35% is expected by in situ combustion. From an important amount of technological studies and site operations, this paper selects and presents comments and remarks related to the strategy of the field development, the "continuous front" or "patterns" system, production monitoring, difficulties encountered, etc. In situ combustion is economically advantageous if the reservoir is carefully selected and the applied technology is of an adequate quality and suitable for the respective reservoir.

20636 (NIPER/BDM–0086, pp. 101-112) **The effect of low-temperature oxidation on the fuel and produced oil during in situ combustion.** Mamora, D.D. (Texas A&M Univ., College Station, TX (United States)); Brigham, W.E. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Combustion tube experiments using 10.2° API crude oil were performed, in which a different sample matrix was used in each run. Three matrix types were tested: sand, sand and clay, and sand and sand fines. As a result of the low fuel concentration, low-temperature oxidation (LTO) was observed in the run where the matrix consisted of sand only. High-temperature oxidation (HTO) was observed in runs where either clay or sand fines were part of the matrix. Ignition was not obtained in the LTO run, which had a reaction front temperature of only 350°C (662°F), compared to a combustion front temperature of 500°C (932°F) for the HTO runs. From elemental analysis, the fuel during the LTO run was determined to be an oxygenated hydrocarbon with an atomic oxygen-carbon ratio of 0.3.

20637 (NIPER/BDM–0086, pp. 113-123) **Comprehensive kinetic models for the aquathermolysis of heavy oils.** Belgrave, J.D.M. (Univ. of Calgary, Alberta (Canada)); Moore, R.G.; Ursenbach, M.G. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Aquathermolysis experiments over the temperature range 360 to 422°C were performed on core samples taken from three large bitumen and heavy oil deposits found in Alberta: Athabasca, North

Bodo, and Frisco Countess. The purpose of this work was to facilitate the development of comprehensive thermal cracking models for predicting gas and liquid phase product distributions under conditions anticipated during thermal recovery. Previous studies have shown by material balance on oxygen that water is implicated in many of the chemical reactions leading to the formation of H_2S and CO_2, yet most of the reported thermal cracking studies have not included water. Additionally, experimental investigations in this area have, for the most part, not involved realistic time frames, and as such certain phenomena observed in this work have not been previously reported.

20638 (NIPER/BDM–0086, pp. 127-142) **An evaluation of the benefits of combined steam and fireflooding as a recovery process for heavy oils.** Moore, R.G. (Univ. of Calgary, Alberta (Canada)); Laureshen, C.J.; Belgrave, J.D.M.; Ursenbach, M.G.; Jha, K.N. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Lack of oil mobility is a major problem with in situ combustion field projects, since the combustion front displaces oil into an essentially unheated reservoir. One way of ensuring oil mobility is to utilize steam injection during the early life of the process, and then switch to combustion when heated communication paths have been developed. The in situ combustion characteristics of cores from the Primrose reservoir of Northeastern Alberta were investigated in a comprehensive series of 22 combustion tube tests. The program was carried out in order to evaluate the effectiveness of fireflooding in both cores that had been preheated to the extent that the oil was mobile and in those which were steam-flooded prior to dry combustion. Both normal- and 95% oxygen-enriched air were evaluated. Wet combustion tests were performed utilizing both liquid water and steam injection. The effects of parameters such as pressure, oxygen enrichment and injection flux on the combustion characteristics were examined. This paper will discuss the results of this study, which show that steam co-injection is more effective at lowering the oxygen requirement than was combustion following steam. Additionally, the cores which were preheated exhibited similar oxygen requirements to those which were presteamed to a near-residual saturation.

20639 (NIPER/BDM–0086, pp. 143-157) **The use of air injection to improve the double displacement processes.** Fassihi, M.R. (Amoco Production Co., Houston, TX (United States)); Gillham, T.H. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

The Double Displacement Process (DDP) has been defined as the gas displacement of a water invaded oil column. The purpose of injecting gas into a watered out oil reservoir is to recover more oil by creating a gas cap and thereby allowing gravity drainage of the liquids to occur. During 1994, Amoco Production Company, in partnership with the United States Department of Energy, will initiate the first project to combine air injection with the DDP. Due to the relatively low cost and potential for accelerated recovery, this unique IOR process may prove to be economically viable in low price environment. This report introduces the project by describing: (1) the initial project design, (2) core and fluid property tests, (3) details of the scoping reservoir models, (4) projected production performance and (5) safety considerations.

20640 (NIPER/BDM–0086, pp. 159-167) **Improved sweep efficiency through the application of horizontal well technology in a mature combustion EOR project: Battrum Field, Saskatchewan, Canada.** Ames, B.G. (Mobil Oil Canada, Alberta (Canada)); Grams, R.E.; Pebdani, F.N. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

In-situ combustion has been employed in the Battrum field since 1964. Although the field has responded favorably to combustion, efficiency of the horizontal displacement process appears to be poor in some areas of the field. Injected air and combustion gases accumulate at the top of the reservoir, and injected water moves into a zone of relatively high mobile water saturation, occurring at the base of the reservoir. Rapid breakthrough of the injected fluids increases operating costs due to high gas-oil ratios. Placement of horizontal wells below the combustion gas cap, and conversion to a vertical displacement process is expected to increase oil rate, improve oil recovery, and reduce operating costs.

20641 (NIPER/BDM–0086, pp. 169-177) **Shallow oil production using horizontal wells with enhanced oil recovery techniques.** Satchwell, R.M. (Western Research Institute, Laramie, WY (United States)); Johnson, L.A. Jr.; Trent, R. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Millions of barrels of oil exist in the Bartlesville formation throughout Oklahoma, Kansas, and Missouri. In an attempt to demonstrate that these shallow heavy oil deposits can be recovered, a field project was undertaken to determine the effectiveness of enhanced oil recovery techniques (EOR) employing horizontal wells. Process screening results suggested that thermal EOR processes were best suited for the recovery of this heavy oil. Screening criteria suggested that in situ combustion was a viable technique for the production of these reserves. Laboratory combustion tube tests confirmed that sufficient amounts of fuel could be deposited. The results of the in situ combustion field pilot were disappointing. A total overall recovery efficiency of only 16.0 percent was achieved. Results suggest that the combustion front might have moved past the horizontal well, however elevated temperatures or crude upgrading were not observed. Factors contributing to the lack of production are also discussed.

20642 (NIPER/BDM–0086, pp. 179-201) **Naval Petroleum Reserve No. 3 (NPR-3), Teapot Dome Field, Wyoming: Case history of the in situ combustion pilot operation.** Sarathi, P.S.; Olsen, D.K.; Williams, C.R. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Naval Petroleum Reserve No. 3 (NPR-3) is a federally owned oil field that has been in operation since 1922 and has produced more than 15 million barrels of oil since full production began in 1976. The Shannon sandstone is the shallowest and most productive of nine producing formations at NPR-3. Since only 5% of the Shannon's estimated 144 million bbl of original oil in place (OOIP) was estimated to be recoverable by primary means, studies were undertaken in 1978 to determine the most suitable enhanced oil recovery (EOR) method which would merit a pilot test and could ultimately lead to a fieldwide application.

20643 (NIPER/BDM–0086, pp. 203-206) **Enhanced oil recovery using hydrogen peroxide injection.** Moss, J.T. Jr.; Moss, J.T. BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK

(United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

NOVATEC received an US Patent on a novel method to recovery viscous oil by hydrogen peroxide injection. The process appears to offer several significant improvements over existing thermal methods of oil recovery. Tejas joined NOVATEC to test the process in the laboratory and to develop oil field applications and procedures.

20644 (NIPER/BDM–0086, pp. 229-245) **Koch's experience with deep in situ combustion in Williston basin.** Miller, R.J. (Koch Exploration Co., Wichita, KS (United States)). BDM Oklahoma, Inc., Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Feb 1995. (CONF-940450–: Field application in situ combustion practices: past, present and future applications, Tulsa, OK (United States), 21-22 Apr 1994). In *Field application of in situ combustion – past performance/future application: Proceedings.* 248p. Order Number DE95000130. Source: OSTI; NTIS; GPO Dep.

Koch Exploration Company has been active with the combustion process in the Williston basin of North and South Dakota since 1979. Koch has three ongoing combustion projects in the basin. The Medicine Pole Hills Unit (MPHU) and the Capa Madison Unit (CMU) are located in the North Dakota, while the Buffalo Unit is situated in South Dakota. Because of low primary recovery from these deep carbonate reservoirs, studies were conducted to determine how the large volume of remaining oil could be recovered, and decisions were made to initiate an in situ combustion by air injection, pressure maintenance project in these reservoirs. The principal objective of this talk is to review the past performance of these combustion projects and discuss some of the operating problems we encountered. The other objectives are to outline the economics of the projects and to speculate on the future of in situ combustion technology as Koch sees it.

0204 Processing

Refer also to citation(s) 20538, 20558, 20674

20645 (CONF-941022–Vol.2, pp. 593-607) **The U.S. Department of Energy's Oil Processing Program.** Harstein, A.M. (Dept. of Energy, Washington, DC (United States)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy's (DOE) Office of Gas and Petroleum Technology (OGPT) has been engaged in a strategic planning activity in response to the changing needs of the oil and gas industry and DOE's expanding role to address these needs. The Oil Processing sub-program is an important element of the OGPT program and is the topic of this paper. The major components of the Oil Processing Strategic Plan are described including the Mission, Situation Analysis, Vision of the Future, Strategic Goals, Strategic Barriers, and Objectives and Strategies.

20646 (CONF-941022–Vol.2, pp. 867-874) **Utilization of the spent caustics generated in the petroleum refineries in the crude distillation unit.** Sarkar, G.N. (Indian Oil Corporation Ltd., Vadodara (India)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Generally 2 to 3 mg caustic per Litre of Crude Oil is used in the desalting Unit to take care of the acid generated from the Calcium and magnesium chlorides present in the crude Oil. Another 7-8 mg caustic is again added per litre of crude Oil to take care of the residual chlorides left over after desalting in the atmospheric distillation column. The spent caustics from the refineries contains a considerable amount of free sodium Hydroxide along with the pollutants like Sulphides, Phenolics and Mercaptides. The various distillation cuts contain considerable amount of Phenols, thioPhenols, Mercaptans etc. and can sustain with the finished streams from them with the stipulated specification. In the present work it is shown that the addition of this spent caustic in the crude oil will not only save the consumption of fresh caustic but will also solve the disposal problem which is major concern for pollution and at the same time will not deteriorate the products as well as equipments.

20647 (DOE/ER/13291–T1) **Interphase transport and multistage separations. Final report, September 1, 1984–August 31, 1994.** Stewart, W.E. Wisconsin Univ., Madison, WI (United States). Dept. of Chemical Engineering. 4 Aug 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13291. Order Number DE95011594. Source: OSTI; NTIS; GPO Dep.

This report gives a summary of the research accomplished under this project which included: Collocation analysis of multistage separation systems; Heat and mass transport fundamentals; Fractionation tray modeling; and Computational and statistical methods. The large equation sets encountered in tray-by-tray modeling of distillation systems are a major obstacle in computer-aided process engineering. The authors addressed this difficulty by approximating the multistage equations with much smaller sets, obtained by orthogonal polynomial interpolation over the stages. A new approach to column design was initiated when they discovered how to extend their collocation formulas to modules containing non-integer numbers of stages. This extension proved equally useful for column simulations in the presence of more than one liquid phase. They also investigated strategies to handle locally steep concentration profiles and high-purity separations. As a basis for realistic modeling of fractionating trays, a comprehensive comparison of various computation methods for multicomponent mass transfer was undertaken. A theoretical study was carried out for asymptotic forms for heat and mass transfer rates in boundary layers. Newton's method was used in several of the computational algorithms for equation solving, parametric sensitivity analysis and nonlinear parameter estimation. The authors investigated modifications of the Newton method designed to achieve convergence over a wider range of initial guesses. Other computer codes have been enhanced as a result of this project.

0206 Health and Safety

Refer also to citation(s) 22399

20648 (BNL–61736) **USDOE study: Human health and ecological risk assessment for produced water discharges.** Meinhold, A.F.; Holtzman, S.; DePhillips, M.; Hamilton, L.D. Brookhaven National Lab., Upton, NY (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9411228–1: Minerals Management Service Information transfer meeting, New Orleans, LA (United States), 15-17 Nov 1994). Order Number DE95012317. Source: OSTI; NTIS; GPO Dep.

Produced water generated during the production of oil and gas can contain high concentrations of radionuclides, organics and heavy metals. There are concerns about potential human health and ecological impacts from the discharge of these contaminants to the Gulf of Mexico. Data collected in the United States Department of Energy (USDOE) field study are being used in a series of human health and ecological risk assessments. These assessments will support scientifically-based regulation and risk management. This presentation: summarizes risk assessments performed for produced water discharges; describes how uncertainties in these assessments are guiding data collection efforts in the USDOE field study; and outlines ongoing risk assessment studies. In these studies, risk assessment is treated as an iterative process. An initial screening-level assessment is performed to identify important contaminants, transport and exposure pathways, and parameters. These intermediate results are used to guide data collection efforts and refinements to the analysis. At this stage in the analysis, risk is described in terms of probabilities; the uncertainties in each measured or modeled parameter are considered explicitly.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 21419

20649 (DOE/EIA–0109(95/02)) **Petroleum supply monthly, February 1995, with data for December 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 27 Feb 1995. 160p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95007674. Source: OSTI; NTIS; GPO; GPO Dep.

Data presented in the Petroleum Supply Monthly (PSM) describe the supply and disposition of petroleum products in the US and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the US (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in primary supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. Data presented in the PSM are divided into two sections: Summary Statistics and Detailed Statistics. The tables and figures in the Summary Statistics section of the PSM present a time series of selected petroleum data on a US level. The detailed Statistics tables of the PSM present statistics for the most current month available as well as year-to-date. In most cases, the statistics are presented for several geographic areas–the US (50 States and the District of Columbia), five PAD Districts, and 12 Refining Districts. 16 figs., 66 tabs.

20650 (DOE/EIA–0109(95/05)) **Petroleum supply monthly, May 1995 with data for March 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 25 May 1995. 183p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012808. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of four publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other publications are the Weekly Petroleum Status Report (WPSR), the Winter Fuels Report, and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in primary supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States.Data presented in the PSM are divided into two sections: Summary Statistics and Detailed Statistics.

20651 (DOE/EIA–0340(94)/1) **Petroleum supply annual 1994. Volume 1.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 22 May 1995. 190p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012803. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

The Petroleum Supply Annual (PSA) contains information on the supply and disposition of crude oil and petroleum products. The publication reflects data that were collected from the petroleum industry during 1994 through annual and monthly surveys. The PSA is divided into two volumes. This first volume contains four sections: Summary Statistics, Detailed Statistics, Refinery Capacity, and Oxygenate Capacity each with final annual data. The second volume contains final statistics for each month of 1994, and replaces data previously published in the Petroleum Supply Monthly (PSM). The tables in Volumes 1 and 2 are similarly numbered to facilitate comparison between them. Below is a description of each section in Volume 1 of the PSA.

20652 (DOE/EIA–0340(94)2) **Petroleum supply annual 1994, Volume 2.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. Jun 1995. 599p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013380. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Petroleum Supply Annual (PSA) contains information on the supply and disposition of crude oil and petroleum products. The publication reflects data that were collected from the petroleum industry during 1994 through annual and monthly surveys. The PSA is divided into two volumes. This first volume contains four sections: Summary Statistics, Detailed Statistics, Refinery Capacity, and Oxygenate Capacity each with final annual data. The second volume contains final statistics for each month of 1994, and replaces data previously published in the Petroleum Supply Monthly (PSM). The tables in Volumes 1 and 2 are similarly numbered to facilitate comparison between them. Explanatory Notes, located at the end of this publication, present information describing data collection, sources, estimation methodology, data quality control procedures, modifications to reporting requirements and interpretation of tables. Industry terminology and product definitions are listed alphabetically in the Glossary.

20653 (DOE/EIA–0380(95/05)) **Petroleum marketing monthly, May 1995 with data for February 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 9 May 1995. 212p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011870. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane. The Petroleum Marketing Division, Office of Oil and Gas, Energy Information Administration ensures the accuracy, quality, and confidentiality of the published data in the Petroleum Marketing Monthly.

20654 (DOE/EIA–0520(95/05)) **International petroleum statistics report, May 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 30 May 1995. 79p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012806. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1985, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for the world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1994; OECD stocks from 1973 through 1994; and OECD trade from 1983 through 1993.

20655 (DOE/EP/10050–T5) **Recent hydrocarbon developments in Latin America: Key issues in the downstream oil sector.** Energy investment advisory series: No. 4. Wu, K.; Pezeshki, S. East-West Center, Honolulu, HI (United States). Mar 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-93EP10050. Order Number DE95011465. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following: (1) An overview of major issues in the downstream oil sector, including oil demand and product export availability, the changing product consumption pattern,

and refineries being due for major investment; (2) Recent upstream developments in the oil and gas sector in Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Trinidad and Tobago, and Venezuela; (3) Recent downstream developments in the oil and gas sector in Argentina, Chile, Colombia, Ecuador, Mexico, Peru, Cuba, and Venezuela; (4) Pipelines in Argentina, Bolivia, Brazil, Chile, and Mexico; and (5) Regional energy balance. 4 figs., 5 tabs.

20656 (DOE/IG–0370) **Audit of staffing requirements for the Strategic Petroleum Reserve.** USDOE Office of Inspector General, Washington, DC (United States). 29 Mar 1995. 59p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Report to The Secretary.

The Department of Energy's (Department) Strategic Petroleum Reserve (Reserve) is responsible for storing large quantities of crude oil, currently about 592 million barrels, to reduce the impact of any future supply disruptions. The Reserve facilities consist of a marine terminal and five underground storage sites located in Louisiana and Texas, and program and administrative offices in New Orleans and Washington, DC. At May 31, 1994, 1,692 Departmental and contractor personnel were employed in the operation, maintenance, and administration of Reserve activities and the Fiscal Year 1994 Congressional Appropriation was about $207 million. The audit was requested by the Deputy Secretary of Energy to assist Departmental management in evaluating the human resources required to meet Reserve program requirements. Specifically, the objective of the audit was to determine whether current staffing levels for the Reserve were necessary to effectively and efficiently accomplish current and future anticipated mission requirements. The Secretary's goal of having the Department and its contractors embrace the best management practices in other Government agencies and industry to improve processes and eliminate waste has not been fully realized by Reserve management. We identified industry performance levels and staffing practices that, if achieved by the Reserve, could enable the Reserve to eliminate approximately 329 positions in eight functional areas with potential annual savings of about $16 million. Our analysis indicated that additional staffing reductions are possible over the long term through further application of industry practices and decreases in the number of managers. However, such staffing reductions will require further analysis by management to determine the specific number of staffing reductions that are attainable. The actual staffing reductions realized by the Reserve will be heavily influenced by several factors.

0209 Environmental Aspects

Refer also to citation(s) 21107, 21537, 22354

20657 (ANL/EAD/TM–43) **Potential environmental benefits from regulatory consideration of synthetic drilling muds.** Burke, C.J. (Argonne National Lab., IL (United States). Environmental Assessment Div.); Veil, J.A. Argonne National Lab., IL (United States). Feb 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95011787. Source: OSTI; NTIS; INIS; GPO Dep.

When drilling exploration and production wells for oil and gas, drillers use specialized drilling fluids, referred to as muds, to help maintain well control and to remove drill cuttings from the hole. Historically, either water-based muds (WBMs) or oil-based muds (OBMs) have been used for offshore wells. Recently, in response to US Environmental Protection Agency (EPA) regulations and drilling-waste discharge requirements imposed by North Sea nations, the drilling industry has developed several types of synthetic-based muds (SBMs) that combine the desirable operating qualities of OBMs with the lower toxicity and environmental impact qualities of WBMs. This report describes the operational, environmental, and economic features of all three types of muds and discusses potential EPA regulatory barriers to wider use of SBMs.

20658 (DOE/MT/94003–3) **Assistance to the states with risk based data management. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Underground Injection Practices Research Foundation, Oklahoma City, OK (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94MT94003. Order Number DE95012187. Source: OSTI; NTIS; GPO Dep.

This report describes activities associated with the risk based data management systems (RBDMS) project. The RBDMS applies to data pertaining to injection well operations. This report describes assistance provided to the states of ALaska, Mississippi, Montana, and Nebraska for the conversion of data from existing data management systems, coding and internal testing of the RBDMS, document preparation, training, technology transfer, and project management.

20659 (DOE/MT/95006–1) **Environmental Assessment of Oklahoma abandoned drilling and production sites and associated public education/outreach activities. Quarterly technical progress report, February 8, 1995–March 30, 1995. First quarter of 1995.** Terry, M. Oklahoma Energy Resources Board, Oklahoma City, OK (United States). 27 Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-95MT95006. Order Number DE95012443. Source: OSTI; NTIS; GPO Dep.

The purpose of this project was to conduct environmental assessments of abandoned oil and gas drilling sites where no responsible owner can be found and transfer environmental technology to oil and gas operators; and provide a comprehensive public education program concerned with the oil and gas industries.

20660 (PNL-SA–24717) **Enhancing in situ bioremediation with pneumatic fracturing.** Anderson, D.B.; Peyton, B.M.; Liskowitz, J.L.; Fitzgerald, C.; Schuring, J.R. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9404265–1: 3. international symposium in situ and on-site bioreclamation, San Diego, CA (United States), 24-27 Apr 1994). Order Number DE95012394. Source: OSTI; NTIS; INIS; GPO Dep.

A major technical obstacle affecting the application of in situ bioremediation is the effective distribution of nutrients to the subsurface media. Pneumatic fracturing can increase the permeability of subsurface formations through the injection of high pressure air to create horizontal fracture planes, thus enhancing macro-scale mass-transfer processes. Pneumatic fracturing technology was demonstrated at two field sites at Tinker Air Force Base, Oklahoma City, Oklahoma. Tests were performed to increase the permeability for more effective bioventing, and evaluated the potential to increase permeability and recovery of free product in low permeability soils consisting of fine grain silts, clays, and sedimentary rock. Pneumatic fracturing significantly improved formation permeability by enhancing secondary permeability and by promoting removal of excess soil moisture from the unsaturated zone. Post-fracture airflows were 500% to 1,700% higher than prefracture airflows for specific fractured intervals in the formation. This corresponds to an average prefracturing permeability of 0.017 Darcy, increasing to an average of 0.32 Darcy after fracturing. Pneumatic fracturing also increased free-product recovery rates of number 2 fuel from an average of 587 L (155 gal) per month before fracturing to 1,647 L (435 gal) per month after fracturing.

0210 Legislation and Regulations

Refer also to citation(s) 22971

20661 (ANL/EA/RP–86431) **Analysis of EPA's cost-effectiveness study for the coastal oil and gas effluent limitations guidelines.** Veil, J. Argonne National Lab., IL (United States). May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95011823. Source: OSTI; NTIS; GPO Dep.

The US Environmental Protection Agency (EPA) conducted a cost-effectiveness (CE) analysis to estimate the incremental cost of complying with the proposed effluent limitation guidelines (ELGs) for the coastal oil and gas industry (EPA 1995a). EPA's CE analysis calculates the pounds of each pollutant that would be removed if the chosen discharge option is selected. In 1993, EPA issued final ELGs for the offshore oil and gas industry and published an

offshore CE analysis. The chemical characteristics of produced water from the offshore region are essentially the same as those of produced water from the coastal region. It was surprising, therefore, that EPA chose a much longer list of pollutants and generally stricter weighting factors for the coastal CE analysis. This report reviews the data, assumptions, and analyses used in EPA's coastal CE analysis and identifies alternate data, assumptions, and analyses that could lead to significantly different cost-effectiveness conclusions. Two alternate lists of pollutants are proposed, along with recalculated weighting factors for several pollutants that contributed a large proportion of the total PEs removed–radium, benzo(a)pyrene, boron, and ammonia. By using different combinations of these variables, a range of revised estimates of CE is calculated.

0220 Transport, Handling, and Storage

Refer also to citation(s) 20652, 20678, 20679

0230 Properties and Composition

Refer also to citation(s) 20606

20662 (ANL/ESD/TM–86) **Development of an analytical model for organic-fluid fouling.** Panchal, C.B.; Watkinson, A.P. Argonne National Lab., IL (United States). Oct 1994. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013278. Source: OSTI; NTIS; GPO Dep.

The research goal of this project is to determine ways to effectively mitigate fouling in organic fluids: hydrocarbons and derived fluids. The fouling research focuses on the development of methodology for determining threshold conditions for fouling. Initially, fluid containing chemicals known to produce foulant is analyzed; subsequently, fouling of industrial fluids is investigated. The fouling model developed for determining the effects of physical parameters is the subject of this report. The fouling model is developed on the premise that the chemical reaction for generation of precursor can take place in the bulk fluid, in the thermal-boundary layer, or at the fluid/wall interface, depending upon the interactive effects of fluid dynamics, heat and mass transfer, and the controlling chemical reaction. In the analysis, the experimental data are examined for fouling deposition of polyperoxide produced by autoxidation of indene in kerosene. The effects of fluid and wall temperatures for two flow geometries are analyzed. The results show that the relative effects of physical parameters on the fouling rate differ for the three fouling mechanisms. Therefore, to apply the closed-flow-loop data to industrial conditions, the controlling mechanism must be identified.

20663 (CONF-941022–Vol.2, pp. 433-447) **Thickness measurement of JFTOT tube deposits by ellipsometry.** Baker, C. (BP Oil, Sunbury-on-Thames (United Kingdom)); David, P.; Taylor, S.E.; Woodward, A.J. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Thickness measurement of Jet Fuel Thermal Oxidation Test (JFTOT) tube deposits has long been a desirable goal to characterize better the thermal stability of jet fuels. The current visual rating method used for specification purposes suffers from the drawback of operator subjectivity and provides little information on the thickness and volume of deposits, parameters which are far more meaningful for characterizing fuels for users and suppliers. Ellipsometry has been identified as a suitable technique for measuring the thickness of JFTOT tubes. Such a system would be robust and non-destructive; cover the important thickness range with regard to visual ratings; provide quick and easy absolute measurement of thickness; enable single spot and profiling measurements; and there would be no restriction on minimum deposit thickness.

20664 (CONF-941022–Vol.2, pp. 449-461) **Weighing by stopwatch - sorting out the variables in filter blocking tendency.** Hardy, D.R. (Naval Research Lab., Washington, DC (United States)); Beal, E.J.; Hughes, J.M. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

This paper first reviews the work reported in the early 1960's on the major variable governing rate of flow of a liquid through a membrane filter - viscosity. Ignoring this major variable leads to both confusing interpretation of filter blocking tendency (FBT) experiments in the laboratory and also for FBT standard tests which cannot adequately or correctly assess FBT from fuel to fuel. Next, the paper will establish a protocol for correctly assessing any given liquid FBT by first calibrating given porosity membrane filters for viscosity and then for solids content. The technique can then be used to measure not only existent solids in various liquid samples but also solids formed during typical accelerated tests such as the gravimetric JFTOT test (for aviation fuels) or ASTM D5304 (for diesel fuels) using only a stopwatch and graduated cylinder. Accuracy and precision of this "weighing" technique will be compared with direct gravimetric determinations.

20665 (CONF-941022–Vol.2, pp. 463-477) **Monitoring the formation of soluble deposit precursors in fuels with light scattering photometry.** Morris, R.E. (Naval Research Lab., Washington, DC (United States)); Hardy, D.R.; Pande, S.; Wechter, M.A. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The reactions that can take place in hydrocarbon fuels often manifest themselves as an increase in the propensity to form thermally induced soluble reaction products. This is not a one-step process but the result of a multitude of intermediate processes. These intermediate processes will produce a range of soluble products that differ considerably in structure and functionality from the fuel itself. Since these soluble "precursors" can, upon further thermal stress, lead to insoluble products, a method for following their formation could form the basis of a useful predictive measurement. It would also serve as a research tool for following the discrimination between soluble and insoluble product formation. Light scattering photometry was evaluated as a means of monitoring the formation of large soluble product molecules as they are formed in fuels. Changes in light scattering properties were measured after thermal stressing in the presence of dissolved copper and a metal deactivator additive. These results correlated well with the amounts of soluble and insoluble products formed. Fuel changes were detected by light scattering before detectable quantities of insoluble products were produced.

20666 (CONF-941022–Vol.2, pp. 479-493) **An improved reference fuel system: Part 2 - A study of adherent and filterable insolubles formation as functions of trimethylpyrrole concentration in dodecane.** White, E.W. (Naval Surface Warfare Center, Annapolis, MD (United States)); Klinkhammer, M.D. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

At the 4th International Conference on the Stability and Handling of Liquid Fuels, a trimethylpyrrole (TMP)/dodecane reference fuel system for use with ASTM Test Method D2274 was presented. It was concluded that the TMP/dodecane system would have sufficient reproducibility of total insolubles values to serve as a reference fuel system. In this paper, the filterable and adherent insolubles from the same data base are examined. Like the total

insolubles, the FY 91 results for both adherent and filterable were less scattered than the FY 90 data. Both adherent and filterable insolubles were found to be adequately and filterable insolubles were found to be adequately represented as linear functions of the initial TMP concentration. Further, the data support a hypothesis that filterable insolubles do not form in the 16 hours of stress unless the initial TMP concentration is greater than about 25 mg/100 mL. A plot of the FY 91 ratio of adherent insolubles to filterable insolubles as a function of the initial TMP concentration approaches 0.6 at TMP concentrations in excess of 75 mg/100 mL.

20667 (CONF-941022–Vol.2, pp. 495-511) **Revised procedure for the measurement of particulate matter in Naval JP5 aviation turbine fuel (F44; AVCAT) using the contaminated fuel detector (CFD).** McVea, G.G. (Aeronautical and Maritime Research Lab., Victoria (Australia)); Power, A.J. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

USA Military Specification MIL-D-22612 provides a procedure for measurement of particulate levels in Naval aviation gas turbine engine JP5 fuel (F44; RAN AVCAT) using the contaminated fuel detector (CFD). Evaluation of this procedure within the specification has revealed significant shortcomings in the application of the theoretical principles upon which the method is based. CFD measurements have been compared to gravimetric results from ASTM D2276, which provides accurate determination of concentrations of particulate matter in JP5. Inaccuracies evident in the CFD readings have been found to relate to the high sensitivity of the CFD to variations in fuel particulate extinction coefficients (ECs) (relating to fuel sediment colour) and to an error in the application of light transmittance theory in the recommended method. This report demonstrates that accurate CFD determination of JP5 particulate concentrations depends on spectrophotometric measurement of a narrow range of ECs of particulate matter. A range of fuel sediments derived from Australian naval ship and shore fuel storages was studied. It was observed that the CFD plot, which is in light transmittance mode, in theory provides a curved line graph against the gravimetric test results, whereas MIL-D-22612 describes a straight line graph. It was concluded that this must be an approximation. However, conversion of light transmittance data derived from the CFD into the reciprocal logarithm to give light absorbance data was shown to give a straight line graph which corresponded well with the gravimetric results. This relationship depended on construction of the graph on the basis of a narrow range of known particulate ECs. The conversion to absorbance gave improved correlation for JP5 particulate measurements with gravimetric procedures, using the CFD.

20668 (CONF-941022–Vol.2, pp. 513-523) **Effect of metal oxides and tanks' deposits on the oxidative stability of gasoline.** Ivanov, S.K. (SciBulCom, Ltd., Sofia (Bulgaria)); Kalitchin, Z.D.; Georgiev, P.T.; Boneva, M.I.; Tanielyan, S.K. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The present investigation is devoted to assessment of the influence of species isolated from fuel tanks and tank bottoms on the oxidative stability of gasoline. The aim of the paper is to be evaluated quantitatively the effect of rust and tank deposits on the oxidation processes and the storage terms of motor gasoline containing catalytic cracking fraction on the basis of a method developed by us earlier. As a result of the theoretical model and the experiments is found that the deposits decrease the chemical stability of gasoline containing 50% fraction from catalytic cracking, while the rust has no significant influence on this parameter. Correction coefficients are calculated and introduced, taking into account the influence of deposits and rust on the predicted storage terms.

20669 (CONF-941022–Vol.2, pp. 525-539) **Improving storage stability of gasoline using elevated antioxidant concentrations.** Sommer, S. (Israel Fuel Corp. LTD, Tel Aviv (Israel)); Luria, D.; Lavie, I.; Sufrin, J.; Weiss, A.; Shuftan, M. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The purpose of this study was to examine the feasibility of increasing storage-stability of gasoline by blending it with elevated concentrations of standard antioxidants, normally added at low concentrations to gasolines. It was thought that, by raising the concentration of these additives in the gasoline from 25 ppm to 100 ppm, the storage stability of the fuel can be improved. In this study, two types of antioxidants (an aromatic diamine type and an alkylphenol type), and a mixture of the two, were added at different concentrations to two different gasoline blends. The various blends were stored in drums, simulating tank storage conditions, for a period of 25 months. Samples were drawn at varying intervals over the test duration and tested for Existent Gum, Potential Gum, Induction Period and other properties (according to standard ASTM test procedures). It was found that raising the concentrations of the aromatic amine antioxidant adversely effected the storage stability of the gasoline blends, whereas elevated concentrations of the alkylphenol antioxidant indeed improved the gasoline's stability.

20670 (CONF-941022–Vol.2, pp. 541-551) **The effect of some metals on the oxidative and storage stability of gasoline.** Kalitchin, Z.D. (SciBulCom, Ltd., Sofia (Bulgaria)); Ivanov, S.K.; Georgiev, P.T.; Boneva, M.I.; Tanielyan, K. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The catalytic action of transitional metal compounds on the oxidation of organic substrates with atmospheric oxygen has received considerable attention in the literature. The efFect of metal surface (Fe and Zn) on the oxidation processes and storage terms of motor gasoline containing fraction from catalytic cracking have been investigated. Both metals are chosen because they are the main construction material of the fuel tanks. On the basis of the kinetic data the correction coefficient k_m evaluating the influence of metals on the oxidation processes of gasoline has been determined. This correction coefficient is included in the calculation for prediction of the real storage terms of gasoline.

20671 (CONF-941022–Vol.2, pp. 553-570) **Gum formation tendencies of olefinic structures in gasoline and synergistic effect of sulphur compounds.** Nagpal, J.M. (Indian Institute of Petroleum, Dehradun (India)); Joshi, G.C.; Aswal, D.S. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The high octane gasoline pool contains varying amounts of cracked naphthas as an important ingredient in formulating high octane lead free gasoline. The cracked naphthas are largely from Fluidized Catalytic Cracking (FCC) units and to lesser extend from thermal cracking units. While the role of olefinic unsaturation in gum formation during storage of gasoline has been extensively studied, there is little published work on contribution of individual olefin types in storage stability and gum formation tendency of gasoline containing these compound types. In the present work we report our results on storage stability and gum formation tendency of different olefin types present in cracked naphthas through model compound matrix. It is found that cyclic olefins and cyclic diolefins are the most prolific gum formers. We have also studied the role of

sulfur compounds present in the gasolines on gum formation tendency of olefins. While thiols enhance gum formation from all olefinic types, sulfides and disulfides interact depending on the structure of olefins. These can have either an accelerating, or inhibiting effect on gum formation.

20672 (CONF-941022–Vol.2, pp. 571-582) **Intercompatibility of residual fuel blends.** Ben-Asher, J. (Israel Institute of Petroleum and Energy, Tel Aviv (Israel)); Krenis, G.; Luria, D. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

It is a well known fact that two fuel oils, thermally stable by themselves, may produce sludge of asphaltenic nature when blended together. Settling out of asphaltenes from the fuel medium will result in strainer and burner plugging, causing serious operational difficulties in industrial and marine fuel systems. It was the aim of the present study to establish criteria for the phenomenon of incompatibility. The parameters which influence thermal stability of the blend were assessed, and an attempt was made to predict possible separation of asphaltenes from fuel oil mixtures. Fuel oils originating from Brazil, France, Hong-Kong, Greece, U.S.A., Japan as well as locally (Israel) produced residual fuels were mixed. Thermal stability of the blend was determined by ASTM D-4740 method. In some cases, total sediment was measured by ASTM D-4870. Blends of fuels were stored at 50°C to assess the effect of elevated temperatures on thermal stability. It was found that most of the blends were compatible though composed of fuels originating from different refineries. Density, Pour Point, Sulfur content and Xylene Number served as useful tools for predicting the thermal stability of residual fuel blends.

20673 (CONF-941022–Vol.2, pp. 583-592) **Compatibility and stability of residual fuels.** Kassinger, R. (DNV Petroleum Services, Teaneck, NJ (United States)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The stability and compatibility of residual fuels are discussed. A stable fuel is one which contains minimum amount of sediment when produced. On storage sediment level and other properties, such as viscosity do not change significantly over time. Sediment level is currently most widely measured by the IP 375 and/or IP 390 Sediment Test. Stable fuels have sediment levels of $\leq$ 0.1% wt. This test is actually a measure of fuel cleanliness. Compatibility refers to the condition of a blend of two fuel components. Two fuels, each with low sediment content are compatible if the sediment of the resultant blend is low. If on the other hand the sediment level of the blend is significantly higher than the individual components, ($>>$ 0.1%) the fuels are incompatible. The blended fuel itself would be described as unstable. Residual fuels are extremely complex products both physically and chemically. The most widely held view of composition is one in which very large asphaltene molecules are colloidally dispersed in an oil phase (maltenes). The asphaltene molecules have a tendency to agglomerate, and this propensity is a function of the oil phase composition. In stable fuels the oil phase prevents the asphaltene micelles from agglomerating and precipitating as sludge. This is related to the oil phase aromaticity and solvency. In order to be stable the oil continuous phase of a fuel must have a minimum level of aromaticity to keep the asphaltenes in suspension. The asphaltenes themselves vary in the amount of aromaticity is required to prevent their agglomeration. This requirement is related to the origin of the asphaltenes. It is well documented that asphaltenes in thermally cracked or visbroken residues have a higher aromaticity requirement than the asphaltenes from a straight run residue. It was known as far back as 1938 that diluents such as cat cracked gas oil, are excellent cutter stocks for the production of "stable" residual fuels.

20674 (CONF-941022–Vol.2, pp. 609-623) **Mechanisms for ageing of middle distillates manufactured from crude oils.** Derst, P. (Committee Product Application-Fuels, Hamburg (Germany)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

European middle distillate marketers and manufacturers have recently seen a surprising increase of ageing phenomena, mainly in the new eastern provinces of Germany after installation of new home heating oil units. Some of these phenomena remain unexplained, so that the "Committee Product Application-Fuels" of the DGMK (German Society for Petroleum and Coal Science and Technology) agreed to foster a research study with respect to ageing of middle distillates manufactured from mineral oils. As step I a literature search was authorized, as it was felt that since over 50 years of work had been done on the subject without culminating in an overall deterioration and degradation theory yet. What has been found by the search is a majority of papers dealing with the results of ageing processes taken from real life cases and trying to resimulate them in the laboratory while reducing the reaction time. Relatively few papers try to explain chemical/physical reaction mechanisms on which an ageing theory could be built. An obvious problem with testing distillates and presented by many papers is the isolation of a blend component often found harmful for a finished product, from the rest of the fuel components, thus omitting preventative forces or activating/accelerating agents from the findings. Many tests with Light Cat Cycle Oil (LCO) are typical examples. This isolation can explain the many contradictive findings in literature, which this paper will document in detail. The most promising theory requires a set of conditions/chemicals to be met/present to kick off the ageing process and progress it until one of the components is consumed. The paper will provide details on these "danger chemicals" found in literature. Finally the most promising reaction kinetic models found in the literature will be critically reviewed.

20675 (CONF-941022–Vol.2, pp. 625-648) **Evaluation of commercial stability additives in middle distillate fuels.** Waynick, J.A. (Amoco Oil Co., Naperville, IL (United States)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Ten commercial distillate stability additives were evaluated to determine their effect on the stability and chemistry of two distillate fuels. The two fuels were light catalytic cycle oil (LOCO) and a diesel fuel blend containing 15% of the same LOCO. Additives were evaluated for their ability to improve stability as measured by three test procedures. Also, their effect on fuel composition was measured. All additives were essentially sulfur-free nitrogen-containing compounds. Most of the nitrogen in each additive was basic nitrogen. Additive effectiveness did not correlate with total or basic nitrogen content. Additives that were blends of stabilizer, dispersant, and metal deactivator did not show a clear performance improvement when compared to additives of a simpler composition. The most cost-effective additive in improving stability was N,N-dimethylcyclohexylamine, with only one other additive giving comparable performance. One additive decreased stability. All additives were found to inhibit the formation of SMORS, species reputed to be sediment precursors. Also, all additives promoted increased levels of phenalenones that were formed in aged LCCO. The effect on SMORS and phenalenones are consistent with current theories of distillate instability chemistry.

20676 (CONF-941022–Vol.2, pp. 649-665) **The effect of aliphatic olefins on the stability of diesel fuel.** Adiwar (PPPT-MGB LEMIGAS, Jakarta (Indonesia)); Batts, B.D. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United

States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The effect of aliphatic olefins on the storage stability of a number of distillates was observed and characterized, mainly by determining the amounts of total insolubles formed during accelerated ageing. It was observed that the aliphatic olefins, in light cycle oil (LCO), a product of catalytic cracking, accelerated the degradation process in accordance with general expectations and in straight run diesel (SRD) and hydrotreated diesel (HTD), aliphatic olefins were shown to have no effect on stability. However, contrary to expectations, the aliphatic olefins inhibited the degradation process of light waxy gas oil (LWGO). The effect of aliphatic isomers on the degradation of LCO is in the order of terminal olefins < internal olefins < branched chain olefins. The effect of aliphatic olefinic isomers on LWGO is, on the other hand, in the order of terminal olefin > internal olefins > branched chain olefins. Three possible mechanisms to explain the effect of aliphatic olefins on the LCO and LWGO samples are proposed.

20677 (CONF-941022–Vol.2, pp. 667-681) **Chemistry of sediment formation and additive response in cracked middle distillates.** Sharma, Y.K. (Indian Institute of Petroleum, Dehradun (India)); Singh, I.D.; Agrawal, K.M.; Saxena, G.C. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The current trend in middle distillate maximization is to blend significant proportions of cracked stocks. This blending enhances instability of the product which creates application problems. In order to reduce/prevent sediment formation it is essential to understand the chemistry of sediment formation. Further knowledge of sediment precursors in cracked middle distillates facilitates in screening of the suitable additives and in studying their response in prevention of sediment formation. The present paper discusses the characterization of sediment precursors, separated through methanol extraction, employing derivatization technique and FTIR spectroscopy. The effect of few commercial additives on the stability of cracked fuels both under accelerated conditions and ambient storage have also been studied. The study indicated that performance of an additive in cracked middle distillate fuels depends on fuel composition, additive structure and fuel storage conditions. From the comparison of FTIR spectra, it has been concluded that methanol extracts the sediment precursors.

20678 (CONF-941022–Vol.2, pp. 683-696) **A study of the safety of the ASTM D5304 oxygen overpressure stability test.** White, E.W. (Naval Surface Warfare Center, Annapolis, MD (United States)); Flohr, K.W. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

While the test method for assessing distillate fuel storage stability by oxygen overpressure was being evaluated as a potential ASTM standard, a question of its safety was raised, specifically whether the juxta-position of liquid fuel and oxygen at elevated pressure could lead to explosive self ignition. As a consequence, the authors conducted a literature search followed by a small experimental program. The results of those studies show that the temperature and pressure used in Test Method D5304 are probably safely below the conditions that would lead to autoignition of normal middle distillate fuels. However, middle distillate fuels of unknown or unusual sources, or containing additives, e.g. ignition improvers, should be screened before evaluating their stability by Test Method D5304.

20679 (CONF-941022–Vol.2, pp. 697-723) **A comparison of low and high sulfur middle distillate fuels in the United States.** Waynick, J.A. (Amoco Oil Co., Naperville, IL (United States)); Taskila, S.M. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Sixty-nine low sulfur (LS) and twenty-six high sulfur (HS) No. 2 diesel fuel samples were collected from twenty-four marketers throughout the United States in early 1994. Fuel samples were tested for chemical composition, physical properties, and stability. All data was statistically analyzed, and a multi-variable regression analysis was performed to determine predictive equations for stability and cold flow test results. The statistical analysis indicated that other than sulfur and nitrogen levels, the main compositional difference between LS and HS diesel fuels was a partial saturation of poly-aromatics to mono-aromatics in LS fuel. Storage stability via ASTM D4625 was improved in LS fuels compared to HS fuels, and poly-aromatics were identified as important contributors to insolubles formation. Hydroperoxide susceptibility of LS and HS fuels was equivalent and acceptable under conditions of ambient fuel transport and storage. However, under progressively severe thermal and oxidative stress, LS fuels appeared increasingly less stable than HS fuels. Under the most stressful conditions used, average hydroperoxide formation rates for LS and HS fuels had regression equations that differed only by a constant factor. Compositional variables that contributed to secondary and benzylic carbons were found to strongly increase hydroperoxide formation. Examination of the test data also indicated that LS diesel fuels might be less responsive to cold flow improvers than HS diesel fuels.

20680 (CONF-941022–Vol.2, pp. 725-742) **Characterization of Soluble Macromolecular Oxidatively Reactive Species (SMORS) from middle distillate diesel fuels: Their origin and role in instability.** Wechter, M.A. (Univ. of Massachusetts, Dartmouth, MA (United States)); Hardy, D.R. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Compositional characterization of a solid phase material isolated by extraction from filtered liquid phase diesel fuels is reported. This solid phase material (SMORS) is shown to be the product of reactive fuel constituents and intermediate to the formation of fuel insoluble sludge. The composition of this material changes during blending processes and tends to become more oxygen rich and thus more polar. Elemental analysis, average molecular weight and pyrolysis mass spectral data are presented for SMORS from a number of representative blended fuels and their blending stocks. SMORS has been shown to be made up of oxidized trimers, tetramers and possibly higher n-mers of nitrogen containing precursors originally present in the fuel. It is not possible to determine the SMORS precursors in field aged fuel (such as those in this study) since these precursors are essentially depleted from the fuel by the time very small amounts of SMORS have been formed.

20681 (CONF-941022–Vol.2, pp. 743-760) **The effect of increased refining on the lubricity of diesel fuel.** Lacey, P.I. (Southwest Research Institute, San Antonio, TX (United States)); Westbrook, S.R. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. Contract DAAK70-87-C-0043; Contract DAAK70-92-C-0059. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The United States and Europe are mandating increasingly severe diesel fuel specifications, particularly with respect to sulfur content, and in some areas, aromatics content. This trend is directed towards reducing vehicle exhaust emissions and is generally beneficial to fuel quality, ignition ratings, and stability. However,

laboratory studies, as well as recent field experience in Sweden and the United States, indicate a possible reduction in the ability of fuels to lubricate sliding components within the fuel injection system. These factors, combined with the trend toward increasing injection pressure in modern engine design, are likely to result in reduced durability and failure of the equipment to meet long-term emissions compliance. The Belvoir Fuels and Lubricants Research Facility (BFLRF) developed an accelerated wear test that predicts the effects of fuel lubricity on injection system durability. This test now has been widely used by fuel, additive, and equipment manufacturers. Several thousand fuel samples have been evaluated to date, and collectively, they form one of the largest data bases on fuel lubricity currently in existence. This range of data permits a good overview of the commercially available fuels and confirms a general decrease in fuel lubricity due to increasing refining severity. The results indicate that no high-sulfur fuel (> 0.12 wt%) had poor lubricity, while a number of low-sulfur fuels (< 0.05 wt%) did produce unacceptable wear. The lubricity of many severely refined fuels is probably being restored using relatively high concentrations of additive.

20682 (CONF-941022–Vol.2, pp. 761-775) **Stabiliser additive performance in diesel fuels and gas oils meeting new environmental targets.** Batt, R.J. (Associated Octel Company Ltd., Milton Keynes (United Kingdom)); Henry, C.P.; Whitesmith, P.R. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Stabilizer additives have for many years been used to inhibit sediment and gum formation in middle distillates, both to meet national specifications and to allow maximum refinery flexibility. The greater emphasis increasingly placed on air quality requires the production of fuels which not only meet the technical requirements of the end user but which also minimize exhaust pollutant levels. Clean air legislation has targeted sulphur and aromatic contents as a method of reducing noxious emissions. Both can be reduced at the refinery by hydrogen treatment but such processes can have implications for fuel stability. The effects of hydrogen treatment processes on traditionally measured fuel parameters are evaluated and the suitability of these methods for predicting field stability discussed. Potential new problems resulting from increased processing and the resultant removal of natural antioxidants are identified, and the ability of stabilizer and antioxidant additives to resolve these difficulties demonstrated.

20683 (CONF-941022–Vol.2, pp. 777-791) **US diesel fuel reformulation: Additive technology in response to changing fuel properties.** Street, J.P. (Nalco/Exxon Energy Chemicals, Sugar Land, TX (United States)); Muth, C.L.; Porlier, B.W. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Rules promulgated by the US Environmental Protection Agency have forced US refiners and importers to radically change their product. While gasoline has held most of the attention, the regulations covering mid-distillates are also extensive, beginning with particulate and emissions standards in the mid-1980's and ending with the reformulation rules that began in October 1993. The assessment of sulfur and aromatic content as deleterious resulted in the final rules for on-highway fuels which specify a 0.05 wt.% limit on sulfur content and a fuel cetane index $\geq$ 40 to control aromatics. Fuels not meeting the on-highway requirements are required to be dyed blue (later changed to red) for easy identification. Most refineries have built or converted hydrotreaters to meet low-sulfur demands. Deep hydrotreating, besides reducing sulfur may change many of the physical/performance properties of the new fuel. Issues and concerns have been raised regarding lubricity, conductivity, corrosion protection, fuel detergency, and low temperature handling properties of the on-highway fuel. Cetane number and stability could be predicted to improve. In practice, however, very slight cetane improvement (approximately 1 cetane number) is being realized. Color stability is greatly improved by hydrotreating, but the same improvement in sediment control has not been uniformly observed. While sludge formation is generally reduced, the inherent solvency of the hydrotreated fuel may also be reduced and sediments may still form. Fuel stability additives can effectively control the residual propensity for sediment formation. Hydrotreating also reduces fuel lubricity, conductivity and corrosion protection. This paper will discuss the additive technology that is effective in meeting the industry needs mentioned above resulting from the October, 1993 US diesel reformulation.

20684 (CONF-941022–Vol.2, pp. 793-802) **The effects of dyeing diesel fuel "blue".** Beal, E.J. (Naval Research Lab., Washington, DC (United States)); Hardy, D.R.; Turner, L.M.; Martin, C.J. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The recent requirement that a blue dye be added to all high sulfur, off-highway diesel fuels raised many concerns among diesel fuel users about the detrimental effects on the fuel of the addition of the blue dye. In order to assess the immediate effect of the blue dye on contamination, the Naval Research Laboratory examined 6 F-76 fuels and all 15 possible 50:50 combinations of these fuels. All fuels were filtered before dyeing to set existing contamination levels to 0 mgs/L. Each fuel was dyed with 30ppm, w/v, of blue dye and allowed to stand for 24 hours in the dark at ambient laboratory conditions. A modified D5452, "Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration" was used to gravimetrically determine the amount of filterable contamination formed in the fuels. The results of these tests, which show that the blue dye caused an immediate detrimental effect in all 6 fuels and 15 fuel combinations, will be given.

20685 (CONF-941022–Vol.2, pp. 803-812) **Lubricity characteristics of low sulfur, low aromatic content naval distillate fuel.** Strucko, R. (Naval Surface Warfare Center, Annapolis, MD (United States)); Giannini, R.M.; Shaver, B.D.; Lacey, P.I. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

California-type diesel fuels are restricted to a maximum sulfur content of 0.05 wt% and a maximum aromatics content of 10 vol% because of environmental regulations. However, there have been instances where these fuels have exhibited low-lubricity characteristics in over-the-road diesel engine operations. The US Navy may be required to use this type of fuel in the near future when operating in California coastal waters. The Navy, therefore, has initiated a program to determine the effects that the increased refining severity employed to achieve the lower sulfur and aromatic limits will have on lubricity, and hence, durability of fuel handling and diesel fuel injection equipment. Fuels conforming to Military Specification MIL-F-1688H, Fuel Naval Distillate (NATO F-76) were obtained from five refineries worldwide. This fuel is the primary fuel used in all US Navy surface ships. Lubricity evaluations will employ the Ball-On-Cylinder Lubricity Evaluator, ASTM D 5001 and the US Army Scuffing Load Wear Test method. A modification to the above tests may be required to account for the uniquely high salt and moisture concentration in Navy fuels before lubricity evaluations of a forty-two sample test fuel matrix will begin.

20686 (CONF-941022–Vol.2, pp. 813-819) **Thermal stability of diesel fuels by quantitative gravimetric JFTOT.** Beal, E.J. (Naval Research Lab., Washington, DC (United States)); Hardy, D.R. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995.

From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The gravimetric jet fuel total oxidation tester (JFTOT) was developed several years ago to provide JFTOT conditions which measure quantitatively the solid/deposit products formed in aviation fuels. The gravimetric JFTOT has now been used to measure these products in a small set of typical diesel fuels. These baseline data are compared to a much larger data base of jet fuels and also several pure compounds. Results from the diesels indicate that the gravimetric JFTOT is a useful concept for ranking fuels for their thermal stability. The diesels ranged from quite low (better than jet) to quite high (an order of magnitude greater than jet fuel) in their deposit forming tendencies. Properly ranked fuels can be used in device tests such as diesel injectors and gas turbine nozzles to assess deposition. In addition, diesels with appropriate viscosities may be able to be used as aviation fuels provided the gravimetric JFTOT gives a low deposition rating.

20687 (CONF-941022–Vol.2, pp. 821-828) **Stability of light straight run diesel fuel during long term underground storage in small size steel tanks.** Geva, J. (Israel Institute for Biological Research, Ness-Ziona (Israel)); Propes, J.; Fass, R.; Sufrin, Y.; Weiss, A.; Schuftan, M.; Lavy, Z. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Three batches of Light Straight Run Diesel Fuel (LSRDF), dyed by a green marker, were stored for five years in precleaned 50,OOOL, steel, cylindrical, underground storage tanks, with or without biocide and a stabilizer additives package. During this period, the fuels were kept dormant and no draining operations were performed. A close follow up on the chemical properties, biocide content and the level of microbial contamination, in the stored fuels, was done throughout the storage experiment. The chemical properties of the untreated fuel remained unchanged but the microbial contamination in "bottom-bottom" samples gradually increased during the first year and remained high for the next four years. In contrast, no microbial activity was found in the treated fuel tanks. However, in the fuel treated only by biocide, the dye green marker gradually diminished while "acidic" odor emitted, however the fuel stayed within chemical specifications range. Fuel treated with stabilizer additives package kept its chemical properties unchanged for the five years storage. The results indicated that untreated LSRDF can be stored for at least five years without any significant microbial or chemical damage, provided good starting condition and no turnover taken place. The biocide treated effectively hindered microbial activity but enhanced a slight oxidation activity in the fuel. Stabilizer additive addition prevented this minor oxidation, while keeping the fuel and the storage tank free from microbial contamination.

20688 (CONF-941022–Vol.2, pp. 829-842) **Storage stability of light cycle oil: Studies for the root substance of insoluble sediment formation.** Motohashi, Katsunori (Chemicals Inspection & Testing Institute, Tokyo (Japan)); Nakazono, Kingo; Oki, Masami. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The storage stabilities of a raw and pretreated light cycle oils (LCOs) have been studied under the condition of ASTM D2274-88. The raw LCO was pretreated by five methods; 10% sulfuric acid-extraction, 10% sodium hydroxide-extraction, methanol-extraction, active clay- treatment, and catalytic hydrotreating. The raw and pretreated LCOs were aged at 95°C for 144 hours while oxygen was bubbled. The pretreatment except 10% sulfuric acid-extraction showed the decreasing sediments. After removing the sediments by filtration, the changes of component of the residual oils before and after aging, were analyzed by GUMS, GC/AED and GC/NPD. Remarkable changes were observed in nitrogen compounds such as anilines and indoles, sulfur compounds such as thiophenols, and oxygen compounds such as phenol and its derivatives. It was clarified that the sediment formation was caused by the mutual interactions among heteroatom-containing compounds mentioned above. In addition, unstable hydrocarbons were suggested to behave as key-compounds for sediment formation.

20689 (CONF-941022–Vol.2, pp. 843-849) **Automatic stability analyzer of heavy fuel oils.** Pilvioe, O. (Neste oy, Porvoo (Finland)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

NESTE has a long history in development of production process and in the improvement of product quality by increasing automated quality adjustment and control. The objective has been to raise production efficiency and to ensure the maintenance of quality levels when using different crude oil grades, and to make economically such products that meet the requirements of the market.

20690 (CONF-941022–Vol.2, pp. 875-888) **Analysis of sulfur-organic compounds in jet fuel by chromatographic sniffing and gas chromatography with atomic emission detector.** Skoog, P.A. (Celsius Materialteknik AB, Linkoeping (Sweden)). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

When the Swedish Air Force changed fuel from Jet B to Jet A-1 during 1991-1992, a working environmental problem was reported from the military air force bases. The symptoms were unpleasant odor, headache and indisposition. This problem arose from some batches of the new fuel, Jet A-1. In order to investigate the compounds in the fuel which gave rise to this problem a chromatographic sniffing technique (sensory analysis) was used. The identification of the compounds from the sniffing analysis was done with a atomic emission detector for gas chromatography. The problem stemmed from relatively volatile sulfur-organic compounds. An interesting question is if these compounds also are strongly involved in the fuel system deposit formation. This presentation shows this new analysis technique and the complex pattern of sulfur-organic compounds related to fuels from different refinery processes.

20691 (CONF-941022–Vol.2, pp. 889-903) **Automated deposit-measuring device (ADMD).** Stavinoha, L.L. (Southwest Research Institute, San Antonio, TX (United States)); McInnis, L.A. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

The Automated Deposit-Measuring Device (ADMD) was developed and fabricated for the evaluation of lacquer-type fuel and lubricant deposits on Jet Fuel Thermal Oxidation Test (JFTOT), ASTM D 3241, heater test tubes. The ADMD employs commercially available components that provide enhanced speed and accuracy of data acquisition as well as improved maintainability, as compared to the prototype Deposit-Measuring Device (DMD) developed in an Army/Navy program. Application of power to the ADMD automatically brings up an operator selection menu on the vacuum fluorescent display. One of five modes of operation can be selected, including both short and long JFTOT tube length and

transference of data from random access memory (RAM) to a personal computer (PC) diskette, if the ADMD is already attached to a PC. Maximum breakdown voltage for the DMD is 1,500 volts, compared to 1,372 volts in the ADMD. This difference in voltage will affect maximum measurable volume of deposit, causing the ADMD to sometimes yield a smaller total volume than the DMD. This fact is a problem only with the thicker deposits. The repeatability of the ADMD is at least as reliable as that of the DMD. Comparison of the ADMD values with the old and current values of the DMD reveals a compatibility between the two devices. The correlation between the volume of deposit of the ADMD and carbon burnoff is superior to the correlation between the volume of deposit of the DMD and carbon burnoff. The ADMD is a viable and reliable instrument for measuring deposit on JFTOT standard and long test tubes. This report describes the ADMD features and compares correlations to DMD data and carbon burnoff data. Advantages and limitations of ADMD-derived data are demonstrated and discussed.

20692 (CONF-941022–Vol.2, pp. 905-917) **Investigation of sensitivity to microbial infection of diesel fuel at the refinery stage.** Thomsen, E.S. (Soren Schierbeck & Co., Helsingor (Denmark)); Petersen, S. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

In the practice of a company dealing with microbial problems of contaminated fuels, it was possible to use associations of microorganisms in research. These associations of "wild" microorganisms appeared successful in the environment of ship's fuel tanks, causing severe problems at the consumer level. Fresh "raw" diesel fuel was treated with the cultures to investigate the sensitivity of the fuel to microbial contamination at the refinery stage. The fuel samples received from Danish refineries were specified as free of any additives or biocides. Before treatment the samples were tested for the presence of inhibiting substances or contamination. Samples of "raw" fuel were added at 1/10, 1/100 and 1/1000 of contaminated fuel, incubated at 27°C and observed for 14 days. Other samples were incubated at 5°C and combinations of periods at 5° and 27°C. In the absence of water or nutrients the contaminant did not appear to survive and colonize the "raw" fuel, although one sample did produce microbial growth in an order of magnitude corresponding to common definitions of fuel infections. The ability of the two relevant associations of "wild" microorganisms to contaminate the "raw" diesel fuel was not clearly demonstrated at this point.

20693 (CONF-941022–Vol.2, pp. 919-928) **Predicting stability at the refinery using SMORS.** Wechter, M.A. (Univ. of Massachusetts, Dartmouth, MA (United States)); Hardy, D.R. USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Technical Management. Apr 1995. From 5. international conference on stability and handling of liquid fuels; Rotterdam (Netherlands); 3-7 Oct 1994. In *Proceedings of the 5th international conference on stability and handling of liquid fuels. Volume 2.* 514p. Order Number DE95009411. Source: OSTI; NTIS; GPO Dep.

Previous work has described the relationship between the methanol extractable, hexane insoluble material isolated from aged fuel stocks and storage instability. A predictive test for stability which uses this relationship has been suggested for field use. This paper presents results derived from refinery fresh fuel stocks upon being subjected to a standard storage stability test (ASTM D 5304) and subsequent isolation and quantification of SMORS from the filtered product. Additional evidence which links the extractable material (SMORS) with insoluble sediment formed during long term storage is also presented. The authors suggest a predictive test for fuel stability which might be used as early as the refinery and which might serve as a basis for recommending storage terms for fuel stocks.

03 NATURAL GAS

Refer also to citation(s) 21395, 21420

20694 (ETDE-DE–113) **In-plant gas supply. Manual for the practical execution of technical rules. Pt. 1, 2, and 4.** Erdgas Information. Industrie. Berichte und Informationen ueber wirtschaftliche Energieanwendung. Ruhrgas AG, Essen (Germany). Jul 1994. 83p. (In German). Order Number DE95779820. Source: OSTI; NTIS (US Sales Only).

Loose-leaf collection; Pt. 3 will appear in autumn 1995.

The information brochure is in four parts. Part 1: In-plant gas pressure control and measuring systems: - execution variants, - system components, - start-up and maintenance, - gas pressure control and measuring system. Part 2: The in-plant gas network: - choice of material, - network construction, - test methods, - corrosion protection, - maintenance. Part 3: - missing. Part 4: Compilation of important technical rules: - gas quality, - pressure control, - granting of approval seals. (HW)

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 20605, 20609, 21418

20695 (DOE/MC–28176-95/C0468) **Atlas of major Appalachian basin gas plays.** Aminian, K.; Avary, K.L.; Baranoski, M.T.; Flaherty, K.; Humphreys, M.; Smosna, R.A. Appalachian Oil and Natural Gas Research Consortium, Morgantown, WV (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-91MC28176. (CONF-950494–7: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012308. Source: OSTI; NTIS; GPO Dep.

This regional study of gas reservoirs in the Appalachian basin has four main objectives: to organize all of the -as reservoirs in the Appalachian basin into unique plays based on common age, lithology, trap type and other geologic similarities; to write, illustrate and publish an atlas of major gas plays; to prepare and submit a digital data base of geologic, engineering and reservoir parameters for each gas field; and technology transfer to the oil and gas industry during the preparation of the atlas and data base.

20696 (DOE/MC/30086–95/C0458) **Naturally fractured tight gas reservoir detection optimization.** Decker, D. Advanced Resources International, Inc., Arlington, VA (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC30086. (CONF-950494–5: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95011340. Source: OSTI; NTIS; GPO Dep.

Exploration strategies are needed to identify subtle basement features critical to locating fractured regions in advance of drilling in tight gas reservoirs. The Piceance Basin served as a demonstration site for an analysis utilizing aeromagnetic surveys, remote sensing, Landsat Thematic Mapper, and Side Looking Airborne Radar imagery for the basin and surrounding areas. Spatially detailed aeromagnetic maps were used to to interpret zones of basement structure.

20697 (DOE/MC/30139–95/C0457) **Preliminary geologic characterization of Upper Cretaceous and Lower Tertiary low-permeability (tight) gas bearing rocks in the Wind River Basin, Wyoming.** Johnson, R.C.; Finn, T.M.; Keefer, W.R.; Flores, R.M.; Keighin, C.W.; Szmajter, R.J.; Nuccio, V.F. Geological Survey, Denver, CO (United States). Petroleum Geology Branch. [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AT21-93MC30139. (CONF-950494–6: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95011339. Source: OSTI; NTIS; GPO Dep.

The geology and stratigraphy of natural gas deposits in the Wind River Basin, Wyoming, was investigated. The study will be utilized to help determine the gas potential of the basin.

20698 (DOE/MC/30139–3971) **Nonassociated gas resources in low-permeability sandstone reservoirs, lower tertiary Wasatch Formation, and upper Cretaceous Mesaverde Group, Uinta Basin, Utah.** Fouch, T.D.; Schmoker, J.W.; Boone, L.E.; Wandrey, C.J.; Crovelli, R.A.; Butler, W.C. Geological Survey, Lakewood, CO (United States). Aug 1994. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AT21-93MC30139. Order Number DE95000055. Source: OSTI; NTIS; GPO Dep.

The US Geological Survey recognizes six major plays for nonassociated gas in Tertiary and Upper Cretaceous low-permeability strata of the Uinta Basin, Utah. For purposes of this study, plays without gas/water contacts are separated from those with such contacts. Continuous-saturation accumulations are essentially single fields, so large in areal extent and so heterogeneous that their development cannot be properly modeled as field growth. Fields developed in gas-saturated plays are not restricted to structural or stratigraphic traps and they are developed in any structural position where permeability conduits occur such as that provided by natural open fractures. Other fields in the basin have gas/water contacts and the rocks are water-bearing away from structural culmination's. The plays can be assigned to two groups. Group 1 plays are those in which gas/water contacts are rare to absent and the strata are gas saturated. Group 2 plays contain reservoirs in which both gas-saturated strata and rocks with gas/water contacts seem to coexist. Most units in the basin that have received a Federal Energy Regulatory Commission (FERC) designation as tight are in the main producing areas and are within Group 1 plays. Some rocks in Group 2 plays may not meet FERC requirements as tight reservoirs. However, we suggest that in the Uinta Basin that the extent of low-permeability rocks, and therefore resources, extends well beyond the limits of current FERC designated boundaries for tight reservoirs. Potential additions to gas reserves from gas-saturated tight reservoirs in the Tertiary Wasatch Formation and Cretaceous Mesaverde Group in the Uinta Basin, Utah is 10 TCF. If the potential additions to reserves in strata in which both gas-saturated and free water-bearing rocks exist are added to those of Group 1 plays, the volume is 13 TCF.

20699 (DOE/MC/31182–95/C0479) **Fractal modeling of natural fracture networks.** Ferer, M.; Dean, B.; Mick, C. West Virginia Univ. Research Corp., Morgantown, WV (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-94MC31182. (CONF-950494–10: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012263. Source: OSTI; NTIS; GPO Dep.

West Virginia University will implement procedures for a fractal analysis of fractures in reservoirs. This procedure will be applied to fracture networks in outcrops and to fractures intersecting horizontal boreholes. The parameters resulting from this analysis will be used to generate synthetic fracture networks with the same fractal characteristics as the real networks. Recovery from naturally fractured, tight-gas reservoirs is controlled by the fracture network. Reliable characterization of the actual fracture network in the reservoir is severely limited. The location and orientation of fractures intersecting the borehole can be determined, but the length of these fractures cannot be unambiguously determined. Because of the lack of detailed information about the actual fracture network, modeling methods must represent the porosity and permeability associated with the fracture network, as accurately as possible with very little a priori information. In the sections following, the authors will (1) present fractal analysis of the MWX site, using the box-counting procedure; (2) review evidence testing the fractal nature of fracture distributions and discuss the advantages of using the fractal analysis over a stochastic analysis; and (3) present an efficient algorithm for producing a self-similar fracture networks which mimic the real MWX outcrop fracture network.

0303 Drilling, Production, and Processing

Refer also to citation(s) 20626, 20658, 20695, 21418

20700 (DOE/MC/26026–4058) **A novel geotechnical/geostatistical approach for exploration and production of natural gas from multiple geologic strata. [Quarterly] technical progress report, January–March 1995.** Brunk, R.G. West Virginia Coll., Beckley, WV (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-89MC26026. Order Number DE95014979. Source: OSTI; NTIS; GPO Dep.

The project objective is to verify a development strategy for high grading areas of multistrata (shallow gas sand and coalbeds) potential in southern West Virginia and test it in up to five wells. Accomplishments for the quarter are presented briefly for the following tasks: Alaskan energy development;dewatering/production extension test period; and demonstrate newly developed technologies for multi strata gas and water production to enhance commercial application.

20701 (DOE/MC/28178–95/C0467) **Evaluation of high-efficiency gas liquid contactors for natural gas processing.** Palla, N.; Lee, A.L. Institute of Gas Technology, Des Plaines, IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract FC21-92MC28178. (CONF-950494–18: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012309. Source: OSTI; NTIS; GPO Dep.

The objectives of this program are to develop and evaluate advanced processing technologies that can reduce the cost of upgrading sub quality natural gas to pipeline standards. The successful application of cost-effective, new technologies will facilitate the production of sub quality natural gas that otherwise would be too expensive to produce. The overall program is focused on the following activities: evaluation of the potential of structured packing for the removal of acid gases from natural gases, and expansion of the currently available database of the fluid dynamics of rotating gas liquid contactors. The natural gas sweetening, structured packing field tests are scheduled to be conducted in calendar year 1995. Design, procurement and construction of the field test unit. Expansion of the available data base on the hydraulic characteristics of a rotating gas-liquid contactor is being pursued through a series of laboratory experiments. A 100 GPM, low pressure rotary contactor system has been assembled at IGT's Energy Development Center to examine the fluid dynamic behavior of this type of contactor. The studies are determining the effects of liquid viscosity, liquid surface tension and operating conditions on liquid residence times and flooding limits.

20702 (DOE/MC–29252-95/C0460) **Development of a Near-Bit MWD system.** McDonald, W.J.; Pittard, G.T. Maurer Engineering, Inc., Houston, TX (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC29252. (CONF-950494–13: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012312. Source: OSTI; NTIS; GPO Dep.

The project objective is to develop a measurements-while-drilling (MWD) module that provides real-time reports of drilling conditions at the bit. The module is to support multiple types of sensors and to sample and encode their outputs in digital form under microprocessor control. The assembled message is to be electromagnetically transmitted along the drill string back to its associated receiver located in a collar typically 50–100 feet above the bit. The receiver demodulates the transmitted message and passes it data to the third party wireline or MWD telemetry system for relay to the surface. The collar also houses the conventional MWD or wireline probe assembly. The completed Phase 1 program began with the preparation of detailed performance specifications and ended with the design, fabrication and testing of a functioning prototype. The prototype was sized for operation with 6-3/4-inch multi-lobe mud motors due to the widespread use of this size motor in horizontal and directional drilling applications. The Phase 1 prototype provided inclination, temperature and pressure information. The Phase 2 program objective is to expand the current sensor suite to include at least one type of formation evaluation measurement, such as formation resistivity or natural gamma ray. The Near-Bit system

will be subjected to a vigorous series of shock and vibration tests followed by field testing to ensure it possesses the reliability and performance required for commercial success.

20703 (DOE/MC/29470–95/C0466) **Low quality natural gas sulfur removal/recovery.** Siwajek, L.A. (Acrion Technologies, Inc., Cleveland, OH (United States)); Kuehn, L. CNG Research Co., Pittsburgh, PA (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29470. (CONF-950494–17: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012310. Source: OSTI; NTIS; GPO Dep.

The project comprises a Base Program and an Optional Program. The Base Program, which included NEPA reporting, process design and an experimental research plan for the optional program, was completed August 31, 1993 with submission of the Task 2 Final Report. The Optional Program, Task 3, began in July 1994. The project goal is to further develop and demonstrate two of the component technologies of the CFZ-CNG Process: (1) pilot-scale triple-point crystallization of carbon dioxide, producing commercially pure carbon dioxide from contaminated carbon dioxide at the rate of 25 ton/day, and (2) bench-scale modified high pressure Claus technology, recovering elemental sulfur from hydrogen sulfide at the rate of 200 lb/day.

20704 (DOE/MC/30070–95/C0470) **Application of microseismic technology to hydraulic fracture diagnostics: GRI/DOE Field Fracturing Multi-Sites Project.** Wilmer, R. (CER Corp., Las Vegas, NV (United States)); Warpinski, N.R.; Wright, T.B.; Branagan, P.T.; Fix, J.E. CER Corp., Las Vegas, NV (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract FC21-93MC30070. (CONF-950494–8: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012307. Source: OSTI; NTIS; GPO Dep.

The objective of the Field Fracturing Multi-Sites Project (M-Site) is to conduct field experiments and analyze data that will result in definitive determinations of hydraulic fracture dimensions using remote well and treatment well diagnostic techniques. In addition, experiments will be conducted to provide data that will resolve significant unknowns with regard to hydraulic fracture modeling, fracture fluid rheology and fracture treatment design. These experiments will be supported by a well-characterized subsurface environment as well as surface facilities and equipment conducive to acquiring high-quality data. It is anticipated that the project's research advancements will provide a foundation for a fracture diagnostic service industry and hydraulic fracture optimization based on measured fracture response. The M-Site Project is jointly sponsored by the Gas Research Institute (GRI) and the US Department of Energy (DOE). The site developed for M-Site hydraulic fracture experimentation is the former DOE Multiwell Experiment (MWX) site located near Rifle, Colorado. The MWX project drilled three closely-spaced wells (MWX-1, MWX-2 and MWX-3) which were the basis for extensive reservoir analyses and tight gas sand characterizations in the blanket and lenticular sandstone bodies of the Mesaverde Group. The research results and background knowledge gained from the MWX project are directly applicable to research in the current M-Site Project.

0304 Products and By-Products

Refer also to citation(s) 21101, 21102, 21104, 21106

20705 (DOE/MC/32073–95/C0464) **Thermoacoustic natural gas liquefier.** Swift, G.W. (Los Alamos National Lab., NM (United States)). USDOE Morgantown Energy Technology Center, WV (United States); Los Alamos National Lab., NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). (CONF-950494–16: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012320. Source: OSTI; NTIS; GPO Dep.

In collaboration with Cryenco Inc. and NIST-Boulder, we intend to develop a natural gas-powered natural-gas liquefier which has absolutely no moving parts and requires no electrical power. It will have high efficiency, remarkable reliability, and low cost. Progress on the liquefier to be constructed at Cryenco continues satisfactorily. The thermoacoustic driver is still ahead of the pulse tube refrigerator, because of NIST's schedule. We completed the thermoacoustics design in the fall of 1994, with Los Alamos providing physics input and checks of all aspects, and Cryenco providing engineering to ASME code, drafting, etc. Completion of this design represents a significant amount of work, especially in view of the many unexpected problems encountered. Meanwhile, Cryenco and NIST have almost completed the design of the pulse tube refrigerator. At Los Alamos, we have assembled a half-size scale model of the thermoacoustic portion of the 500 gal/day TANGL. This scale model will enable easy experimentation in harmonic suppression techniques, new stack geometries, new heat-exchanger geometries, resonator coiling, and other areas. As of March 1995, the scale model is complete and we are performing routine debugging tests and modifications.

0305 Health and Safety

Refer also to citation(s) 20648

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 20655, 20715

20706 (DOE/EIA–0130(95/05)) **Natural gas monthly, May 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 24 May 1995. 112p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012801. Source: OSTI; NTIS; GPO; GPO Dep.

The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

20707 (DOE/FE–0336) **Natural gas imports and exports: First quarter report 1995.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Fuels Programs. [1995]. 184p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014292. Source: OSTI; NTIS; GPO Dep.

The Office of Fuels Programs prepares quarterly reports summarizing the data provided by companies authorized to import or export natural gas. Companies are required, as a condition of their authorizations, to file quarterly reports with the OFP. This quarter's focus is market penetration of gas imports into New England. Attachments show the following: % takes to maximum firm contract levels and weighted average per unit price for the long-term importers, volumes and prices of gas purchased by long-term importers and exporters, volumes and prices for gas imported on short-term or spot market basis, and gas exported short-term to Canada and Mexico.

20708 (INIS-mf–14540) **The future of gas: a global challenge. Conference book.** No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

Six papers were presented at the conference discussing global aspects of modern state and future trends of using natural gas for energy production, emphasizing economical and environmental issues.

20709 (INIS-mf–14540, pp. 1-9) **The impact of technology on gas reserves, worldwide and in the Middle East.** Dunlop, N. (SSI Consulting (United Kingdom)); Speers, G.R. No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas:*

a global challenge. Conference book. Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

This paper reviews the distribution of gas reserves both worldwide and the Middle East. As more gas is produced in difficult environments, either at long distances from markets or from more complex reservoirs there is a need to curtail costs by improving exploration success, reducing well costs and by increasing the reserves produced per well. Continuing advances in technology can make a major impact in achieving these goals. Historically, the innovative use of technology has resulted in significant increases in the value of oil and gas developments. (Author). 5 fig.

20710 (INIS-mf–14540, pp. 11-20) **Middle East gas utilization and export potential.** Cornet-Gandolphe, S. (Cedigaz, Paris (France)). No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas: a global challenge. Conference book.* Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

There is huge gas supply potential in the Middle East, which possesses over one third of the world's natural gas reserves. However, marketed production represents only 6% of the world total, demonstrating that gas resources in the Middle East are under utilized. The value of these resources will be realized only if the gas finds a commercial outlet that guarantees proper return on investments for gas producers and the best possible use of this nonrenewable resource for governments. Apart from the chemical sector, which has provided a good outlet for natural gas, the development of natural gas resources in the region has been very limited historically, inhibited by many factors linked to the resource itself and to the characteristics of the region. However, natural gas in the Middle East is now at a crossroads, facing both major challenges and significant opportunities. The region, which currently plays only a marginal role on the world gas market, has the potential to become a leading world supplier, provided a number of political and economic conditions are fulfilled. This paper discusses some of the challenges that Middle Eastern countries face in trying to develop their natural gas resources. It reviews development potential for Middle Eastern gas reserves, whether for local use and/or exports, and it highlights future opportunities. (Author).

20711 (INIS-mf–14540, pp. 21-35) **Middle East gas export projects: The case of Abu Dhabi.** Al Marzooqi, H. (Abu-Dhabi National Oil Co., Abu Dhabi (United Arab Emirates)). No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas: a global challenge. Conference book.* Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

Abu Dhabi is ranked in the industry journals in the top 5 in the world tables of both oil and gas reserves. Gas is produced both Onshore and Offshore from associated and non-associated fields. Production has tripped during the last ten years and will increase further in the next few years as a result of current and planned investment. Development of Abu Dhabi's gas resources is aimed at enhancing oil production and recovery, meeting local and export demand and eliminating waste. Companies in Abu Dhabi are involved in all the main sectors of gas industry including production, processing, transportation and sales. The first large LNG export project by sea in Arabian Gulf was established in 1977 from Abu to Japan. Development continues and the gas is exported as LNG and is also processed into LPG and Pentane Plus for export. Japan remains the main market. The volume of Condensate available for export and processing will increase significantly in the next few years. In order to ensure a continuing and increasing supply of gas to world markets, in future years, prices will need to provide an adequate return on investment and should also reflect the environmental advantages of gas. 9 tabs.

20712 (INIS-mf–14540, pp. 36-50) **The environment and its impact on gas penetration in the energy market east.** Mabro, R.E. (Oxford Inst. for Energy Studies (United Kingdom)); Stoppard, M. No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas: a global challenge. Conference book.* Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

The thesis of this paper is that gas, although free from pollution problems is nevertheless more benign generally appreciated. The obstacles to gas penetration are flawed environmental legislation, political factors and,in some areas, a cost disadvantage relative to other fuels which turn out to be higher than the environmental premium which society is prepared to pay. (Author).

20713 (INIS-mf–14540, pp. 57-73) **The Japanese approach to financing LNG projects.** Aoki, Wataru (Qatar LNG Investment Co. (Qatar)). No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas: a global challenge. Conference book.* Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

The Japanese approach approach to financing LNG project has been what could be called a combined purchase and finance system which has been arranged mainly at the initiative of japan's Sogo Shosh (general trading companies) with the support of japanese governmental financial agencies and a purchase commitment from japanese utilities. In the QATARGAS project, despite it being the first greenfield LNG project in decade since North West Shelf Australia LNG project, financing for the LNG plant phase has been successfully arranged through Japanese financing. The structuring of the financial facilities for the QATARGAS project seems to have lessons for future development of the next generation of greenfield LNG projects. Discharge of the parties' liability, proper sharing of the risk burden and reconfirmation of the spirit of mutual understanding and trust among the parties concerned are key factors for the success of any new LNG project in the future. (Author).

20714 (INIS-mf–14549, pp. 11-15) **Consequences of increasing the consumption of gaseous fuels in national economy.** Farsky, M. (Fakulta Socialne Ekonomicka, Universita J. E. Purkyne, Usti nad Labem (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

Coal is currently the predominating energy source in the Czech Republic (a share of about 65%) as against European Union countries where oil and gas are predominantly used (about 60%). Gas imports and uses in the Czech Republic are expected to increase in the future. This increase will be primarily governed by rationalization of heating oil consumption and by a favorable trade and pricing policy. The increase in the share of gas in electricity generation will also alleviate environmental problems. Average emissions from the combustion of brown coal, bituminous coal, heating oil and natural gas are given. A forecast of primary energy source uses in the Czech Republic till 2005 is presented, and gas balance data for Germany are given. (J.B.). 3 tabs.

0308 Environmental Aspects

Refer also to citation(s) 20657, 20658, 20659, 20709, 20712, 21107

20715 (INIS-mf–14540, pp. 51-56) **Economics of LNG and pipeline gas export from GC C.** White, N. (Athur D. Little London (United Kingdom)). No corporate text available. 1995. 73p. (CONF-9503152–: 1. Doha conference on natural gas, Doha (Qatar), 13-15 Mar 1995). In *The future of gas: a global challenge. Conference book.* Order Number DE95631159. Source: OSTI; NTIS (US Sales Only); INIS.

This paper briefly reviews the economic and non-economic considerations underlying gas exports from the GC C and the Arabian Peninsula in general. It addresses four themes: policy issues, political risks, technical risks and economics. It examines the distance between the regional resource areas and the major gas markets in the Far East and Europe, and examines the implications for moving gas to those markets in liquid form or by pipeline, in terms of number of LNG vessels required, and capital costs. (Author).

20716 (INIS-mf–14549) **Power industry and the environment IV. Natural gas.** DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. 173p. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad

Labem (Czech Republic), 25-26 Oct 1994). Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

The proceedings include a supplement.

A total of 26 contributions to the conference are presented, two of them in a Supplement. Seven contributions have been inputted in INIS, viz.: Natural gas: an environmentally friendly and energy saving fuel; Pollutants from the combustion of fuels; Consequences of increasing the consumption of gaseous fuels in national economy; Conversion of energy sources to gas consumption: effects on air quality; Experience of the Czech National Energy Inspectorate from the conversion of energy sources in the North-Bohemian region to gas fuel; Environmental consequences of gas fuel uses in towns; Natural gas: evaluation, control, and improvement of its environmental impacts; and Cogeneration units. (J.B.).

20717 (INIS-mf–14549, pp. 1-5) **Natural gas: an environmentally friendly and energy saving fuel.** Malinsky, J. (Ceske Plynarenske Podniky s.p., Transgas o.z. (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

The advantages of natural gas as an environmentally friendly fuel are highlighted; they primarily include minimal and temporary land occupation during pipeline construction, and minimal emissions of harmful substances from combustion. The problems of emissions of nitrogen oxides and ways of their reduction are discussed. Nitrogen oxide emission data for brown coal combustion are given for comparison. Emissions of carbon dioxide from brown coal, bituminous coal, liquid fuels and natural gas are also compared, and the contributions of the fuels to the greenhouse effect are given. The favorable properties of natural gas and the feasibility of its rational use are outlined. (J.B.). 3 figs.

20718 (INIS-mf–14549, pp. 6-10) **Harmful emissions from the combustion of fuels.** Benes, M. (Vysoka Skola Chemicko-Technologicka, Prague (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

Problems of emissions arising from the combustion of solid, liquid and gaseous fuels are discussed. The maximum permissible concentrations of particulate matter, sulfur dioxide, nitrogen oxides, carbon dioxide, and carbon monoxide are given for energy and power generating facilities of 0.2 to 5 MW thermal output. The advantage of electricity generation and centralized heat supply experienced at the site of consumption is partly offset by the disadvantage of a large environmental burden at the site where electricity is generated and/or water heated. (J.B.). 1 tab.

20719 (INIS-mf–14549, pp. 23-28) **Conversion of energy and power sources to gas fuel: effects on air quality.** Pretel, J. (Czech Ecological Inst., Prague (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

The consequences of converting a facility from brown coal fuel to gas fuel were analyzed by model simulation. Treated were a district heating plant with an output of 700 TJ/yr and minor local heating sources (stoves) at a density of 1 family house per 100 m^2. Emissions of particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and hydrocarbons before and after the conversion are given for the two types of source. Conversion of a major air pollution source to gas fuel would result in a reduction of the contribution of sulfur dioxide emissions of the order of 10^{-4}, of particulate matter and carbon monoxide of the order of 10^{-3}, and of hydrocarbons of the order of 10^{-2}. The decrease will be lowest for nitrogen oxides, viz. about 40%. Analogous data for local heating sources in towns would be 10^{-5} for sulfur dioxide, 10^{-4} for particulate matter, 10^{-3} for carbon monoxide and hydrocarbons, and roughly one order of magnitude for nitrogen oxides. (J.B.).

20720 (INIS-mf–14549, pp. 44-48) **Environmental consequences of gas fuel uses in towns.** Novak, L. (Mestsky Urad Decin, Decin (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

Gas distribution was commenced in the town of Decin in 1991. As a result, the consumption of coal decreased to less than one-half. An overview is given of the shares of coal, gas and fuel oils in heat generation in Decin, as well as of the mean annual concentrations of sulfur dioxide and nitrogen oxides over the 1989 to 1993 period.

20721 (INIS-mf–14549, pp. 56-62) **Natural gas: evaluation, control, and improvement of its environmental impacts.** Wilkinson, A. (British Gas plc, London (United Kingdom)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

The decrease in SO_2 and NO_x emissions in the United Kingdom since 1950 resulting from a reduction in coal uses and conversion to gas heating is described. The use of gas to satisfy the increasing energy consumption expected in the Czech Republic till 2010, which corresponds to 3.2 million tons of oil equivalent, would bring about an 88 kt reduction in ash production by the power industry, and an air pollution reduction by 6 million tons of CO_2, 353 kt of SO_2, 25 kt of CO, 15 kt NO_x, and 1.6 kt of CH_4. In households, where energy use is estimated to 2 million tons of oil equivalent in 2010, the air pollution alleviation due to the replacement of lignite by gas is estimated to 5 million tons of CO_2, 307 kt of SO_2, 77 kt of particulate matter, 22 kt of CO, and 13 kt of NO_x. The RandD activities of British Gas plc in the field of quantification and characterization of relevant impacts and in the preparation of cost-effective solutions for the reduction of wastes are highlighted. (J.B.).

20722 (INIS-mf–14549, pp. 74-79) **Cogeneration units.** Dvorak, V. (Cesky Plynarensky a Naftovy Svaz, Prague (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

The principles are outlined of cogeneration, i.e. of combined generation of electricity and heat. The assets of this approach include a decrease in the consumption of primary sources, and lower air pollution. Replacement of 1000 MWe brown coal fired power sources by cogeneration units in the Czech Republic would imply the shutdown of 3 to 4 brown coal fired power plants, bringing about a reduction in SO_2, NO_x and particulate emissions by 13.4%, 7%, and 4.3%, respectively. (J.B.).

0310 Legislation and Regulations

Refer also to citation(s) 20661, 22971

0320 Transport, Handling, and Storage

20723 (DOE/MC/31113–95/C0471) **Underground natural gas storage reservoir management.** Ortiz, I.; Anthony, R. United Energy Development Consultants, Inc., Ambridge, PA (United States). [1995]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-94MC31113. (CONF-950494–9: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012306. Source: OSTI; NTIS; GPO Dep.

The objective of this study is to research technologies and methodologies that will reduce the costs associated with the operation and maintenance of underground natural gas storage. This effort will include a survey of public information to determine the amount of natural gas lost from underground storage fields, determine the causes of this lost gas, and develop strategies and remedial designs to reduce or stop the gas loss from selected fields. Phase I includes a detailed survey of US natural gas storage reservoirs to determine the actual amount of natural gas annually lost from underground storage fields. These reservoirs will be ranked, the resultant will include the amount of gas and revenue annually lost. The results will be analyzed in conjunction with the type (geologic) of storage reservoirs to determine the significance and impact of the gas loss. A report of the work accomplished will be prepared. The report will include: (1) a summary list by geologic type of US gas storage reservoirs and their annual underground gas storage losses in ft^3; (2) a rank by geologic classifications as to the amount of gas lost and the resultant lost revenue; and (3) show the level of significance and impact of the losses by geologic type. Concurrently, the amount of storage activity has increased in conjunction with the net increase of natural gas imports as shown on Figure No. 3. Storage is playing an ever increasing importance in supplying the domestic energy requirements.

0330 Properties and Composition

Refer also to citation(s) 21105, 21705, 21706

0340 Combustion

Refer also to citation(s) 20586, 20589, 21157, 21167, 21536, 21813

20724 (DTU-LV–95-13) **Natural gas/solar heating systems. Market analysis.** Boye-Hansen, L.; Furbo, S. Danmarks Tekniske Univ., Lyngby (Denmark). Lab. for Varmeisolering. Jun 1995. 21p. (In Danish). Contract ENS-51181-94.0092. Order Number DE95787735. Source: OSTI; NTIS.

It has been shown that if solar heating systems are installed at the same time as natural gas systems, costs will be reduced by half. Here a boiler would be attached to the wall and a separate hot water tank, heated up by both the natural gas boiler and the solar collectors, would be utilized. An investigation based on telephone interviews was made in order to analyse the market for such combined systems. The investigation is described and the results are discussed. (AB)

20725 (LUTMDN-TMVK–7021) **Time resolved measurements of flow fields and heat release in pulse combustors.** Lindholm, A. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. May 1995. 64p. Order Number DE95779305. Source: OSTI; NTIS.

Pulsating combustion is a non-steady combustion process where quantities like pressure, temperature, velocity etc., oscillate periodically in time. The oscillations occur spontaneously due to interaction between pressure oscillations and heat release. Pulsating combustion offers advantages like high heat transfer and low emissions of NO_x and CO and a potential of simple design. In this work detailed measurements in the combustion chamber were performed in order to get information about fundamental processes that control the combustion and the operating characteristics of a pulse combustor. An increased theoretical and experimental knowledge may provide possibilities to control the combustion process, and that knowledge can be transferred to a design tool for pulse combustors with very low levels of exhaust emissions and high combustion efficiency. An experimental investigation of flow fields and CH-radical fields in two different combustion chambers of different pulse combustors was performed. Results from measurements from an axisymmetric (square cross section) combustion chamber were compared to measurements from a 'flat' combustion chamber. The results indicate that the fluid dynamic mixing that takes place in the vortices created by the flame holder and the air to fuel ratio control the phase shift between the heat release and pressure. Therefore, it seems likely to achieve operation characteristic control by this means. The emission levels of NO_x are not influenced so much by internal flue gas recirculation from the tail pipe as by the air to fuel ratio and short residence time at high temperatures. Measurements used to support the development of a simulation model indicate that it is possible to simulate the important features of the flow. 45 refs, 34 figs, 8 tabs

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

Refer also to citation(s) 20726

0404 Oil Production, Recovery, and Refining

20726 (DOE/MC/26268–3822) **The extraction of bitumen from western oil sands. Final report, July 1989–September 1993.** Oblad, A.G.; Bunger, J.W.; Dahlstrom, D.A.; Deo, M.D.; Fletcher, J.V.; Hanson, F.V.; Miller, J.D.; Seader, J.D. Utah Univ., Salt Lake City, UT (United States). Mar 1994. 600p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26268. Order Number DE94012256. Source: OSTI; NTIS; GPO Dep.

Research and development of surface extraction and upgrading processes of western tar sands are described. Research areas included modified hot water, fluidized bed, and rotary kiln pyrolysis of tar sands for extraction of bitumen. Bitumen upgrading included solvent extraction of bitumen, and catalytic hydrotreating of bitumen. Characterization of Utah tar sand deposits is also included.

20727 (DOE/MC/27286–3310) **The development of an integrated multistaged fluid bed retorting process. Technical report, October 1, 1992–December 31, 1992.** Taulbee, D. (and others); Fei, Y.; Carter, S. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. Jan 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-90MC27286. Order Number DE95012949. Source: OSTI; NTIS; GPO Dep.

The KENTORT II process includes integral fluidized bed zones for pyrolysis, gasification, and combustion of the oil shale. The purpose of this program is to design and test the KENTORT II process at the 50-lb/hr scale. Along with the major activity of assembling the components of the 50-lb/hr retort, work was also completed in other areas this quarter. Basic studies of the cracking and coking kinetics of model compounds in a fixed bed reactor were continued. Additionally, as part of the effort to investigate niche market applications for KENTORT II-derived products, a study of the synthesis of carbon fibers from the heavy fraction of KENTORT II shale oil was initiated.

05 NUCLEAR FUELS

Refer also to citation(s) 21215, 22954, 22955

0505 Uranium Enrichment

Refer also to citation(s) 20980, 21024, 22456

20728 (JAERI-Research–95-020) **Electron temperature of resonance photoionization plasma measured with Langmuir probe.** Ogura, Koichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Shibata, Takemasa. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 21p. (In Japanese). Order Number DE95780613. Source: OSTI; NTIS; INIS.

Gadolinium plasma was produced in such a way that gadolinium atoms were ionized by two-wavelength two-step laser photoionization with pulsed lasers. Here, an ionization scheme was chosen so as to emit a photoelectron with the kinetic energy of 0.006eV. The electron temperature of plasma was measured with a Langmuir probe 40μs after plasma production. The electron temperature of 0.02-0.03eV was obtained. The real electron temperature was considered to be below 0.02eV considering the uneven work function on probe surface. The electron temperature was much lower than

the atomic excitation temperature of 0.05 to 0.08eV. The temperature did not approach to the atomic excitation temperature through excitation and de-excitation reactions between gadolinium atoms and electrons, since the atomic density was low in this experiment. (author).

0507 Fuels Production and Properties

Refer also to citation(s) 21003, 21264, 21268, 21290, 21786, 21792

20729 (BNL–61520) **Multiple-linac approach for tritium production and other applications.** Ruggiero, A.G. Brookhaven National Lab., Upton, NY (United States). 10 Jan 1995. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95008859. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes an approach to tritium production based on the use of multiple proton linear accelerators. Features of a single APTT Linac as proposed by the Los Alamos National Laboratory are presented and discussed. An alternative approach to the attainment of the same total proton beam power of 200 MW with several lower-performance superconducting Linacs is proposed and discussed. Although each of these accelerators are considerable extrapolations of present technology, the latter can nevertheless be built at less technical risk when compared to the single high-current APT Linac, particularly concerning the design and the performance of the low-energy front-end. The use of superconducting cavities is also proposed as a way of optimizing the accelerating gradient, the overall length, and the operational costs. The superconducting technology has already been successfully demonstrated in a number of large-size projects and should be seriously considered for the acceleration of intense low-energy beams of protons. Finally, each linear accelerator would represent an ideal source of very intense beams of protons for a variety of applications, such as: weapons and waste actinide transmutation processes, isotopes for medical application, spallation neutron sources, and the generation of intense beams of neutrinos and muons for nuclear and high-energy physics research. The research community at large has obviously an interest in providing expertise for, and in having access to, the demonstration, the construction, the operation, and the exploitation of these top-performance accelerators.

20730 (DPW–56-7-6) **Savannah River Plant 100 Area reactors monthly report, June 1956.** Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 Jul 1956. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012029. Source: OSTI; NTIS; GPO Dep.

This report presents details of the operations of the Savannah River Plant manufacturing division during the month of June 1956.

20731 (DPW–56-7-7) **Savannah River Plant 100 Area reactors monthly report, July 1956.** Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 Aug 1956. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012031. Source: OSTI; NTIS; GPO Dep.

This report presents details of the operations of the Savannah River Plant manufacturing division during the month of July 1956.

20732 (HW–8347) **234-5 Project, Hydrofluorination Cycle.** Prudich, T. Hanford Works, Richland, WA (United States). 18 Dec 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013955. Source: OSTI; NTIS; GPO Dep.

Short communication. URANIUM/production; SEPARATION PROCESSES; URANIUM; PRODUCTION

20733 (WSRC-TR–94-100-12) **SRTC Monthly Report December 1994.** Ferrell, J.M. Westinghouse Savannah River Co., Aiken, SC (United States). 19 Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060145. Source: OSTI; NTIS; GPO Dep.

This is the Savannah River Technology Center monthly report for December 1994.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 20975, 20976, 21739, 21744

20734 (ANL/CMT/SUMM–85376) **The development of a bench scale metal distillation furnace (retort).** Vest, M.A.; Smith, J.L.; Pierce, R.D. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950601–13: Annual meeting of the American Nuclear Society (ANS), Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95013701. Source: OSTI; NTIS; INIS; GPO Dep.

An induction heated vacuum furnace was developed for recovering actinides from spent reactor fuel. It was tested by melting 2.7 kg U in beryllia, the retort tested with Zn and Mg.

20735 (BNWL-CC–2591-Rev.1) **Preliminary project proposal for process area ventilation modifications 231-Z Building. Revision 1.** Walters, R.W. Battelle-Northwest, Richland, WA (United States). Pacific Northwest Lab. 13 Jul 1970. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010033. Source: OSTI; NTIS; GPO Dep.

It is proposed to design and install a new heating and ventilation system for the process area of 231-Z Building. The proposed system provides increased ventilation capacity to meet the present process requirements of the building with capacity for modest expansion. A mechanical refrigeration recirculating type system will be utilized in order to improve the process environment by controlling humidity within reasonable limits. The project includes demolition and removal of the existing ventilation system and construction of a new equipment room to house the new equipment. No changes are proposed in the present equipment process exhaust system.

20736 (LA–12938) **Reliability analysis for the facility data acquisition interface system upgrade at TA-55.** Turner, W.J.; Pope, N.G.; Brown, R.E. Los Alamos National Lab., NM (United States). May 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012117. Source: OSTI; NTIS; INIS; GPO Dep.

Because replacement parts for the existing facility data acquisition interface system at TA-55 have become scarce and are no longer being manufactured, reliability studies were conducted to assess various possible replacement systems. A new control system, based on Allen-Bradley Programmable Logic Controllers (PLCs), was found to have a likely reliability 10 times that of the present system, if the existing Continuous Air Monitors (CAMS) were used. Replacement of the old CAMs with new CAMs will result in even greater reliability as these are gradually phased in. The new PLC-based system would provide for hot standby processors, redundant communications paths, and redundant power supplies, and would be expandable and easily maintained, as well as much more reliable. TA-55 is the Plutonium Processing Facility which processes and recovers Pu-239 from scrap materials.

20737 (WHC-SD-CP-TC–033) **Test procedure for anion exchange testing with Argonne 10-L solutions.** Compton, J.A. Westinghouse Hanford Co., Richland, WA (United States). 17 May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013350. Source: OSTI; NTIS; INIS; GPO Dep.

Four anion exchange resins will be tested to confirm that they will sorb and release plutonium from/to the appropriate solutions in the presence of other cations. Certain cations need to be removed from the test solutions to minimize adverse behavior in other processing equipment. The ion exchange resins will be tested using old laboratory solutions from Argonne National Laboratory; results will be compared to results from other similar processes for application to all plutonium solutions stored in the Plutonium Finishing Plant.

0509 Transport, Handling, and Storage

Refer also to citation(s) 20757, 21025, 21035, 21549, 21758, 21759, 21760, 21761, 21762, 21763, 21766, 21772, 21785, 21786, 21789

20738 (ANL/EA/CP–84161) **Assessment of risks to individuals from the transportation of radioactive materials.** Biwer, B.M.; Monette, F.A.; LePoire, D.J.; Chen, S.Y. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950216–148: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95013392. Source: OSTI; NTIS; INIS; GPO Dep.

The radiological impacts to individuals from the transportation of radioactive materials must be assessed when evaluating alternatives for major federal actions as required by the National Environmental Policy Act. Public comments on past environmental impact statements indicate that the public is concerned about the risks of radiation exposure to individuals along a transport route from radioactive materials shipments. Individuals may be exposed during routine, incident-free, transport of radioactive materials or, potentially, as a result of transportation accidents. This paper discusses the computer model RISKIND, which was developed at Argonne National Laboratory to estimate the potential radiological risks to individuals and population subgroups from the transportation of radioactive materials. The code was designed to use site-specific data to provide a detailed analysis for each receptor location. This type of analysis complements the traditional collective population transportation risk analyses conducted for radiological transportation risk assessments.

20739 (DOE/EA–1009) **Environmental assessment for DOE permission for off-loading activities to support the movement of commercial low level nuclear waste across the Savannah River Site.** USDOE Savannah River Operations Office, Aiken, SC (United States). Feb 1995. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012239. Source: OSTI; NTIS; GPO Dep.

This environmental assessment investigates the potential environmental and safety effects which could result from the land transport of low level radioactive wastes across the Savannah River Plant. Chem-Nuclear Systems operates a low level radioactive waste burial facility adjacent to the Savannah River Plant and is seeking permission from the DOE to transport the waste across Savannah River Plant.

20740 (ORNL/PATS–95-001) **Packaging- and transportation-related occurrence reports, October-December 1994.** Welch, M.J.; Dickerson, L.S.; Armstrong, C.J. Oak Ridge National Lab., TN (United States). Feb 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95009138. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) Packaging and Transportation Safety Program (PATS), which is sponsored by the U.S. Department of Energy (DOE) Office of Environment, Safety and Health, Office of Facility Safety Analysis, EH-32, has been charged with the responsibility of retrieving reports and information pertaining to transportation or packaging incidents from the Occurrence Reporting and Processing System (ORPS). These selected reports are being analyzed for trends, impact on EH-32 policies and concerns, and lessons learned concerning transportation and packaging safety. This task is designed not only to keep EH-32 aware of current packaging and transportation incidents and potential transportation and packaging problems that may need attention on DOE sites but also to allow future dissemination of lessons learned to the Operations Offices and, subsequently, to management and operating contractors. This report, which covers the period from October 2 to December 31, 1994, covers the weekly tabular reports OR-94-40 through OR-94-52. These 12 reports, which contained a total of 75 occurrence reports (ORs) relating to packaging and transportation issues, were submitted to EH-32 for its information and use during this quarter. The 75 ORs that were selected from the hundreds reviewed are listed. The second column of Table I contains the PATS nature of occurrence (NOC) coding for the respective OR, and the third column lists the weekly report issue in which the OR was originally transmitted to DOE-Headquarters (HQ). The Lesson Learned bulletins produced this quarter are included. These two bulletins have been distributed to a large packaging and transportation safety audience and are included as a natural outgrowth of the quarterly reports.

20741 (WHC-SD-SNF-DP–001) **Data compilation report: Gas and liquid samples from K West Basin fuel storage canisters.** Trimble, D.J. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013329. Source: OSTI; NTIS; INIS; GPO Dep.

Forty-one gas and liquid samples were taken from spent fuel storage canisters in the K West Basin during a March 1995 sampling campaign. (Spent fuel from the N Reactor is stored in sealed canisters at the bottom of the K West Basin.) A description of the sampling process, gamma energy analysis data, and quantitative gas mass spectroscopy data are documented. This documentation does not include data analysis.

20742 (WHC-SD-W058-TA–001) **Replacement of the cross-site transfer system liquid waste transport alternatives evaluation, Project W-058.** Vo, D.V.; Epperson, E.M. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012951. Source: OSTI; NTIS; INIS; GPO Dep.

This document examines high-/low-level radioactive liquid waste transport alternatives. Radioactive liquid waste will be transported from the 200 West Area to the 200 East Area and within the 200 East Areas for safe storage and disposal. The radioactive waste transport alternatives are the Aboveground Transport System (French LR-56 Cask System [3,800 L (1,000 gal)]), 19,000-L (5,000-gal) trailer tanker system, 75,700-L (20,000-gal) rail tanker system and Underground Transport System (buried pipe [unlimited transfer volume capability]). The evaluation focused on the following areas: initial project cost, operational cost, secondary waste generation, radiation exposure, and final decommissioning. The evaluation was based on the near term (1995 to 2005) estimated volume of 49.509 million L (13.063 million gal) and long term (1995 to 2028) estimated volume of 757.1 million L (200 million gal). The conclusion showed that the buried pipe (Underground Transport System) resulted in the lowest overall total cost for near and long term, the trailer container resulted in the highest total cost for near and long term, and the French truck was operationally impractical and cost prohibitive.

20743 (WHC-SD-WM-PLN–100) **Waste shipment engineering data management plan.** Marquez, D.L. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012836. Source: OSTI; NTIS; INIS; GPO Dep.

This plan documents current data management practices and future data management improvements for TWRS Waste Shipment Engineering.

20744 (WSRC-TR–95-0228) **Hydrogen Gas Generation from Mark 31 Slugs.** Rudisill, T.S. Westinghouse Savannah River Co., Aiken, SC (United States). 15 May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060150. Source: OSTI; NTIS; GPO Dep.

With the suspension of fuel and target dissolving activities since the early 1990's, irradiated Mark 31 targets (slugs) have been stored in the L-Reactor basin for greater than 7 years. During the prolonged storage, pitting corrosion has breached the thin aluminum cladding of many slugs resulting in corrosion of the uranium core. The products of uranium and metal corrosion are highly visible on the surface of slugs and easily spread throughout the basin environment. The slugs have been placed in stainless steel boxes to prevent the accumulation of corrosion products on the basin floor. When the lids of the boxes are removed to inspect the slugs, large volumes of gas trapped inside the boxes are released. The release of an unknown gas has been identified as a potential safety concern. The physical appearance and storage conditions of the Mark 31 slugs and comparison with the analysis of gas from a leaking can of EBR-II (Experimental Breeder Reactor II) fuel provide convincing evidence that the accumulated gas is hydrogen. Both the Mark 31 slugs and the EBR-II fuel contain depleted uranium metal used for the production of plutonium. Once the uranium core of the slug and fuel assemblies are exposed, the corrosion

mechanism is the same. The analysis of the gas sample collected from the EBR-II fuel can was essentially 100% hydrogen. A black solid powder expelled from the can was also identified as highly oxidized uranium consistent with the physical appearance of uranium dioxide (UO_2). The formation of UO_2 and generation of hydrogen are consistent with the basic mechanism for the aqueous corrosion of uranium metal which is well established and reported throughout the literature.

0520 Waste Management

Refer also to citation(s) 20731, 20733, 20742, 20743, 20972, 20973, 20974, 20981, 20982, 20994, 20997, 21003, 21004, 21011, 21013, 21019, 21023, 21025, 21031, 21039, 21041, 21042, 21045, 21046, 21052, 21216, 21353, 21379, 21403, 21497, 21511, 21543, 21544, 21545, 21546, 21547, 21548, 21720, 21745, 21746, 21748, 21749, 21766, 21788, 21791, 21812, 22168, 22242, 22264, 22313, 22388, 22904

20745 (AFIT/ENS–95-01) **Comparative life-cycle cost analysis for low-level mixed waste remediation alternatives.** Jackson, J.A.; White, T.P.; Kloeber, J.M.; Toland, R.J.; Cain, J.P.; Buitrago, D.Y. Air Force Inst. of Tech., Wright-Patterson AFB, OH (United States). Mar 1995. 302p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011131. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study is two-fold: (1) to develop a generic, life-cycle cost model for evaluating low-level, mixed waste remediation alternatives, and (2) to apply the model specifically, to estimate remediation costs for a site similar to the Fernald Environmental Management Project near Cincinnati, OH. Life-cycle costs for vitrification, cementation, and dry removal process technologies are estimated. Since vitrification is in a conceptual phase, computer simulation is used to help characterize the support infrastructure of a large scale vitrification plant. Cost estimating relationships obtained from the simulation data, previous cost estimates, available process data, engineering judgment, and expert opinion all provide input to an Excel based spreadsheet for generating cash flow streams. Crystal Ball, an Excel add-on, was used for discounting cash flows for net present value analysis. The resulting LCC data was then analyzed using multi-attribute decision analysis techniques with cost and remediation time as criteria. The analytical framework presented allows alternatives to be evaluated in the context of budgetary, social, and political considerations. In general, the longer the remediation takes, the lower the net present value of the process. This is true because of the time value of money and large percentage of the costs attributed to storage or disposal.

20746 (ANL–94/34) **The effects of the glass surface area/solution volume ratio on glass corrosion: A critical review.** Ebert, W.L. (Argonne National Lab., IL (United States). Chemical Technology Div.). Argonne National Lab., IL (United States). Mar 1995. 300p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011008. Source: OSTI; NTIS; INIS; GPO Dep.

This report reviews and summarizes the present state of knowledge regarding the effects of the glass surface area/solution volume (SA/V) ratio on the corrosion behavior of borosilicate waste glasses. The SA/V ratio affects the rate of glass corrosion through the extent of dilution of corrosion products released from the glass into the leachate solution: glass corrosion products are diluted more in tests conducted at low SA/V ratios than they are in tests conducted at high SA/V ratios. Differences in the solution chemistries generated in tests conducted at different SA/V ratios then affect the observed glass corrosion behavior. Therefore, any testing parameter that affects the solution chemistry will also affect the glass corrosion rate. The results of static leach tests conducted to assess the effects of the SA/V are discussed with regard to the effects of SA/V on the solution chemistry. Test results show several remaining issues with regard to the long-term glass corrosion behavior: can the SA/V ratio be used as an accelerating parameter to characterize the advanced stages of glass corrosion relevant to long disposal times; is the alteration of the glass surface the same in tests conducted at different SA/V, and in tests conducted with monolithic and crushed glass samples; what are the effects of the SA/V and the extent of glass corrosion on the disposition of released radionuclides? These issues will bear on the prediction of the long-term performance of waste glasses during storage. The results of an experimental program conducted at ANL to address these and other remaining issues regarding the effects of SA/V on glass corrosion are described. 288 refs., 59 figs., 16 tabs.

20747 (ANL–94/42) **Yucca Mountain Project - Argonne National Laboratory annual progress report, FY 1994.** Bates, J.K.; Fortner, J.A.; Finn, P.A.; Wronkiewicz, D.J.; Hoh, J.C.; Emery, J.W.; Buck, E.C.; Wolf, S.F. Argonne National Lab., IL (United States). Feb 1995. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95010431. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports on the work done by the Nuclear Waste Management Section of the Chemical Technology Division (CMT), Argonne National Laboratory, in the period October 1993-September 1994. Studies have been performed to evaluate the performance of nuclear waste glass and spent fuel samples under unsaturated conditions (low volume water contact) that are likely to exist in the Yucca Mountain environment being considered as a potential site for a high-level waste repository. Tests with simulated waste glasses have been in progress for over eight years and demonstrate that actinides from initially fresh glass surfaces will be released as a result of the spallation of reacted glass layers from the surface, as the small volume of water passes over the waste form. Studies are also underway to evaluate the performance of spent fuel samples and unirradiated UO_2 in projected repository conditions. Tests with UO_2 have been ongoing for nine years and show that the oxidation of UO_2 occurs rapidly, and the resulting paragenetic sequence of secondary phases that form on the sample surface is similar to that observed in natural analogues. The reaction of spent fuel samples under conditions similar to those used with UO_2 have been in progress for nearly two years, and the results suggest that spent fuel follows the same reaction progress as UO_2. The release of individual fission products and transuranic elements was not congruent, with the release being controlled by the formation of small particles or colloids that are suspended in solution and transported away from the waste form. The reaction progress depends on the composition of the spent fuel samples used and, likely, on the composition of the groundwater that contacts the waste form.

20748 (ANL/CMT-ACL/CP–85238) **Waste minimization in analytical methods.** Green, D.W.; Smith, L.L.; Crain, J.S.; Boparai, A.S.; Kiely, J.T.; Yaeger, J.S. Schilling, J.B. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505111–1: 11. pollution prevention conference: shaping the future through pollution prevention involvement - commitment - progress, Knoxville, TN (United States), 16-18 May 1995). Order Number DE95011961. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) will require a large number of waste characterizations over a multi-year period to accomplish the Department's goals in environmental restoration and waste management. Estimates vary, but two million analyses annually are expected. The waste generated by the analytical procedures used for characterizations is a significant source of new DOE waste. Success in reducing the volume of secondary waste and the costs of handling this waste would significantly decrease the overall cost of this DOE program. Selection of appropriate analytical methods depends on the intended use of the resultant data. It is not always necessary to use a high-powered analytical method, typically at higher cost, to obtain data needed to make decisions about waste management. Indeed, for samples taken from some heterogeneous systems, the meaning of high accuracy becomes clouded if the data generated are intended to measure a property of this system. Among the factors to be considered in selecting the analytical method are the lower limit of detection, accuracy, turnaround time, cost, reproducibility (precision), interferences, and simplicity. Occasionally, there must be tradeoffs among these factors to achieve the multiple goals of a characterization program. The purpose of the work described here is to add waste minimization to the list of characteristics to be considered. In this paper the authors present results of modifying analytical methods for waste characterization

to reduce both the cost of analysis and volume of secondary wastes. Although tradeoffs may be required to minimize waste while still generating data of acceptable quality for the decision-making process, they have data demonstrating that wastes can be reduced in some cases without sacrificing accuracy or precision.

20749 (ANL/CMT-ACL/CP–85503) **New analytical methods to minimize secondary waste.** Green, D.W.; Smith, L.L.; Cain, J.S.; Boparai, A.S.; Kiely, J.T.; Yaeger, J.S.; Schilling, J.B. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950690–1: Laboratory safety and environmental management, Baltimore, MD (United States), 27-28 Jun 1995). Order Number DE95014229. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) will require a large number of waste characterizations over a multi-year period to accomplish the Department's goals in environmental restoration and waste management. Estimates vary, but two million analyses annually are expected. The waste generated by the analytical procedures used for characterizations is a significant source of new DOE waste. Success in reducing the volume of secondary waste and the costs of handling this waste would significantly decrease the overall cost of this DOE program. We have chosen to review the analytical procedures in three areas – sample injection for inorganic analysis, dissolution of waste samples for radiochemical analysis, and sample preparation for analysis of organic constituents.

20750 (ANL/CMT/CP–84720) **Alteration of spent fuel matrix under unsaturated water conditions.** Finn, P.A.; Bates, J.K.; Buck, E.C.; Wronkiewicz, D.J.; Hoh, J.C.; Wolf, S.F. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950570–28: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013433. Source: OSTI; NTIS; INIS; GPO Dep.

Drip tests which simulate the unsaturated conditions expected in the potential repository at Yucca Mountain are in progress to evaluate the long-term performance of spent fuel. This paper examines the corrosion behavior of the spent fuel matrix under conditions in which water is introduced at a rate of 1.5 mL every 7 days. Our recent results suggest a rapid reaction rate of the spent fuel matrix, the formation of alteration products that are similar to the sequence found in ore deposits in uranium mines, and the presence of colloidal species in the leachate. These results are compared to results from two models developed for a potential repository in an unsaturated zone.

20751 (ANL/CMT/CP–84882) **Reactivity of high plutonium-containing glasses for the immobilization of surplus fissile materials.** Bates, J.K.; Hoh, J.C.; Emery, J.W.; Buck, E.C.; Fortner, J.A.; Wolf, S.F.; Johnson, T.R. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950570–31: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013472. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments have been performed on glasses doped with 2 and 7 wt % plutonium to evaluate factors that may be important in the performance of these high-Pu-loaded glasses for repository storage. The high Pu loadings result from the need to dispose of excess Pu from weapons dismantling. The glasses were reacted in water vapor to simulate aging that may occur under unsaturated storage conditions prior to contact with liquid water. They were also reacted with liquid water under standard static leach test conditions. The results were compared with similar tests of a reference glass (202 glass) containing only 0.01 wt % Pu. In vapor hydration testing to date, at 2 wt % loading, the Pu was incorporated into the glass without phase separation, and reaction in water vapor proceeded at a rate comparable with that of the 202 glass. At wt % loading, a Pu phase separated and was not uniformly incorporated into the glass. The vapor reaction of this glass proceeded at a more rapid rate. This phase separation was manifested in the static leach tests, where colloidal phases of Pu-rich material remained suspended in solution, thereby increasing the absolute Pu release when compared to the 202 glass.

20752 (ANL/CMT/CP–85474) **Thermal oxidation vitrification flue gas elimination system.** Kephart, W. (Foster-Wheeler Environmental Corp., Oak Ridge, TN (United States)); Angelo, F.; Clemens, M. Argonne National Lab., IL (United States). [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950542–2: 14. international symposium on thermal treatment technologies: incineration conference, Seattle, WA (United States), 8-12 May 1995). Order Number DE95013407. Source: OSTI; NTIS; INIS; GPO Dep.

With minor modifications to a Best Demonstrated Available Technology hazardous waste incinerator, it is possible to obtain combustion without potentially toxic emissions by using technology currently employed in similar applications throughout industry. Further, these same modifications will reduce waste handling over an extended operating envelope while minimizing energy consumption. Three by-products are produced: industrial grade carbon dioxide, nitrogen, and a final waste form that will exceed Toxicity Characteristics Leaching Procedures requirements and satisfy nuclear waste product consistency tests. The proposed system utilizes oxygen rather than air as an oxidant to reduce the quantities of total emissions, improve the efficiency of the oxidation reactions, and minimize the generation of toxic NO_x emissions. Not only will less potentially hazardous constituents be generated; all toxic substances can be contained and the primary emission, carbon dioxide – the leading "greenhouse gas" contributing to global warming – will be converted to an industrial by-product needed to enhance the extraction of energy feedstocks from maturing wells. Clearly, the proposed configuration conforms to the provisions for Most Achievable Control Technology as defined and mandated for the private sector by the Clear Air Act Amendments of 1990 to be implemented in 1997 and still lacking definition.

20753 (ANL/CMT/CP–85710) **Vitrification of low-level radioactive mixed waste at Argonne National Laboratory.** Mazer, J.J.; Rosine, S.D.; No, H.J. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950216–137: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012217. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory-East (ANL-E) is proceeding with plans to use vitrification to treat low-level radioactive mixed wastes (LLMW) generated on-site. The objective is to install a full-scale vitrification system at ANL-E capable of processing the entire annual generation of selected LLMW streams. Crucible glass studies with actual mixed waste streams have produced sodium borosilicate glasses under conditions achievable in commercially available melters. These same glass compositions, spiked with toxic metals above the expected levels in actual wastes, pass the Toxicity Characteristic Leaching Procedure (TCLP) test. Earlier evaluations of the likely off-gases that will result from vitrification indicated that the primary off-gases will include compounds of SO_x, NO_x, and CO_2. These evaluations are being experimentally confirmed with a mass spectrometer analysis of the gases evolved from samples of the ANL-E wastes. The composition of the melter feed can be adjusted to minimize volatilization of some components, if necessary. The full-scale melter will be designed to handle the annual generation of at least three LLMW waste streams: evaporator concentrator bottoms sludge (ECB), storage tank sludge (STS), and HEPA filter media. Each waste stream is mixed waste by virtue of its failure to pass the TCLP test with respect to toxic metal leaching. Additional LLMW streams under consideration for vitrification include historical mixed waste glass from past operations and spent abrasive from a planned decontamination facility.

20754 (ANL/EA/CP–84132) **Computer-aided waste management strategic planning and analysis.** Avci, H.I.; Kotek, T.J.; Koebnick, B.L. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950216–140: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012466. Source: OSTI; NTIS; INIS; GPO Dep.

A computational model called WASTE-MGMT has been developed to assist in the evaluation of alternative waste management approaches in a complex setting involving multiple sites, waste streams, and processing options. The model provides the quantities and characteristics of wastes processed at any facility or shipped between any two sites as well as environmental emissions at any facility within the waste management system. The model input is defined by three types of fundamental waste management data: (1) waste inventories and characteristics at the point of generation; (2) treatment, storage, and disposal facility characteristics; and (3) definitions of alternative management approaches. The model has been successfully used in the preparation of the US Department of Energy (DOE) Environmental Management Programmatic.Environmental Impact Statement (EM PEIS). Certain improvements are either being implemented or planned that would extend the usefulness and applicability of the WASTE-MGMT model beyond the EM PEIS and info the. strategic planning for management of wastes under the responsibility of DOE or other agencies.

20755 (ANL/EA/CP–84317) **Facility accident analysis for low-level waste management alternatives in the US Department of Energy Waste Management Program.** Roglans-Ribas, J.; Mueller, C.; Nabelssi, B.; Folga, S.; Tompkins, M. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950216–143: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012287. Source: OSTI; NTIS; INIS; GPO Dep.

The risk to human health of potential radiological releases resulting from facility accidents constitutes an important consideration in the US Department of Energy (DOE) waste management program. The DOE Office of Environmental Management (EM) is currently preparing a Programmatic Environmental Impact Statement (PEIS) that evaluates the risks associated with managing five types of radiological and chemical wastes in the DOE complex. Several alternatives for managing each of the five waste types are defined and compared in the EM PEIS. The alternatives cover a variety of options for storing, treating, and disposing of the wastes. Several treatment methods and operation locations are evaluated as part of the alternatives. The risk induced by potential facility accidents is evaluated for storage operations (current and projected waste storage and post-treatment storage) and for waste treatment facilities. For some of the five waste types considered, facility accidents cover both radiological and chemical releases. This paper summarizes the facility accident analysis that was performed for low-level (radioactive) waste (LLW). As defined in the EM PEIS, LLW includes all radioactive waste not classified as high-level, transuranic, or spent nuclear fuel. LLW that is also contaminated with chemically hazardous components is treated separately as low-level mixed waste (LLMW).

20756 (ANL/EA/CP–84357) **Characterization of hazardous waste residuals from Environmental Restoration Program activities at DOE installations: Waste management implications.** Lazaro, M.A.; Esposito, M.P. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950216–146: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012939. Source: OSTI; NTIS; INIS; GPO Dep.

Investigators at Argonne National Laboratory (ANL), with support from associates at the Pacific Northwest Laboratory (PNL), have assembled an inventory of the types and volumes of radioactive, toxic or hazardous, and mixed waste likely to be generated over the next 30 years as the US Department of Energy (DOE) implements its nationwide Environmental Restoration (ER) Program. The inventory and related analyses are being considered for integration into DOE's Programmatic Environmental Impact Statement (PEIS) covering the potential environmental impacts and risks associated with alternative management practices and programs for wastes generated from routine operations. If this happens, the ER-generated waste could be managed under a set of alternatives considered under the PEIS and selected at the end of the current National Environmental Policy Act process.

20757 (ANL/EA/CP–85519) **Calculation of projected waste loads for transuranic waste management alternatives.** Hong, K.; Kotek, T.; Koebnick, B.; Wang, Y.; Kaicher, C. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950216–145: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012938. Source: OSTI; NTIS; INIS; GPO Dep.

The level of treatment and the treatment and interim storage site configurations (decentralized, regional, or centralized) impact transuranic (TRU) waste loads at and en route to sites in the US Department of Energy (DOE) complex. Other elements that impact waste loads are the volume and characteristics of the waste and the unit operation parameters of the technologies used to treat it. Projected annual complexwide TRU waste loads under various TRU waste management alternatives were calculated using the WASTE_MGMT computational model. WASTE_MGMT accepts as input three types of data: (1) the waste stream inventory volume, mass, and contaminant characteristics by generating site and waste stream category; (2) unit operation parameters of treatment technologies; and (3) waste management alternative definitions. Results indicate that the designed capacity of the Waste Isolation Pilot Plant, identified under all waste management alternatives as the permanent disposal facility for DOE-generated TRU waste, is sufficient for the projected complexwide TRU waste load under any of the alternatives.

20758 (ANL/EA/SUMM–84815) **Environmental evaluations in the Multi-Purpose Canister Environmental Impact Statement.** Parker, G. (USDOE, Washington, DC (United States)); Kim, D.; Marmer, G.; LaGory, K. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950570–29: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013386. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. CONTAINERS/design; WASTE TRANSPORTATION/environmental impacts; SPENT FUEL STORAGE/environmental impacts; ENVIRONMENTAL IMPACT STATEMENTS; CONTAINERS; DESIGN; LAND USE; AIR QUALITY; OCCUPATIONAL SAFETY; SOCIO-ECONOMIC FACTORS

20759 (ANL/RA/SUMM–85653) **Performance assessment modeling of high level nuclear wasteforms from the pyroprocess fuel cycle.** Nutt, W.M. (Argonne National Lab., IL (United States)); Hill, R.N.; Bullen, D.B. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950570–30: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013470. Source: OSTI; NTIS; INIS; GPO Dep.

Several performance assessment (PA) analyses have been completed to estimate the release to the accessible environment of radionuclides from spent light water reactor (LWR) fuel emplaced in the proposed Yucca Mountain repository. Probabilistic methods were utilized based on the complexity of the repository system. Recent investigations have been conducted to identify the merits of a pyroprocess fuel cycle. This cycle utilizes high temperature molten salts and metals to partially separate actinides and fission products. In a closed liquid metal reactor (LMR) fuel cycle, this allows recycling of nearly all of the actinides. In a once-through cycle, this isolates the actinides for storage into a wasteform which can be specifically tailored for their retention. With appropriate front-end treatment, this Process can also be used to treat LWR spent fuel.

20760 (ANL/RE/CP–85929) **Sloshing analysis of viscous liquid storage tanks.** Uras, R.Z. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–63: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014221. Source: OSTI; NTIS; INIS; GPO Dep.

The effect of viscosity on the sloshing response of tanks containing viscous liquids is studied using the in-house finite element

computer code, FLUSTR-ANL. Two different tank sizes each filled at two levels, are modeled, and their dynamic responses under harmonic and seismic ground motions are simulated. The results are presented in terms of the wave height, and pressures at selected nodes and elements in the finite element mesh. The viscosity manifests itself as a damping effect, reducing the amplitudes. Under harmonic excitation, the dynamic response reaches the steady-state faster as the viscosity value becomes larger. The fundamental sloshing frequency for each study case stays virtually unaffected by an increase in viscosity. For the small tank case, a 5% difference is observed in the fundamental frequency of the smallest (1 cP) and the highest (1000 cP) viscosity cases considered in this study. The fundamental frequencies of the large tank are even less sensitive.

20761 (ANL/RE/CP–85952) **Sloshing impact in roofed tanks.** Uras, R.A. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–64: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014219. Source: OSTI; NTIS; INIS; GPO Dep.

A large number of high-level waste (HLW) storage tanks exists in various tank farms. Seismic activities at those locations may cause significant sloshing in HLW tanks. These tanks are covered to avoid any spilling during large amplitude earthquakes. However, large amplitude sloshing may result in impact on the cover or the roof of the tank. Hence, a better understanding of the impact phenomenon is necessary to assess the safety of the tanks currently in existence, and to establish design guidelines for future designs. A pressure based formulation is derived to model sloshing impact in roared tanks. It is incorporated into Argonne's in-house finite element code FLUSTR-ANL. A numerical test case with a harmonic input excitation is studied. The simulation results indicate that linear behavior is preserved beyond the first impact, and some mesh distortion is observed following a stronger second impact. During the impact, the displacement of the contacting surface nodes remains constant, and the velocities are reduced to zero. An identification of impacting nodes is possible from the dynamic pressures induced in surface elements.

20762 (ANL/TD/CP–82910) **Spent fuel pyroprocessing demonstration.** McFarlane, L.F.; Lineberry, M.J. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950311–1: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95011957. Source: OSTI; NTIS; INIS; GPO Dep.

A major element of the shutdown of the US liquid metal reactor development program is managing the sodium-bonded spent metallic fuel from the Experimental Breeder Reactor-II to meet US environmental laws. Argonne National Laboratory has refurbished and equipped an existing hot cell facility for treating the spent fuel by a high-temperature electrochemical process commonly called pyroprocessing. Four products will be produced for storage and disposal. Two high-level waste forms will be produced and qualified for disposal of the fission and activation products. Uranium and transuranium alloys will be produced for storage pending a decision by the US Department of Energy on the fate of its plutonium and enriched uranium. Together these activities will demonstrate a unique electrochemical treatment technology for spent nuclear fuel. This technology potentially has significant economic and technical advantages over either conventional reprocessing or direct disposal as a high-level waste option.

20763 (ANL/TD/CP–86243) **A FIDAP and an empirical estimate of conjugate heat transfer of a graphite crucible.** Bateman, K.J.; Clarksean, R.L. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9504145–2: Fluid dynamics international (FIDAP) users conference, Chicago, IL (United States), 30 Apr - 2 may 1995). Order Number DE95011850. Source: OSTI; NTIS; GPO Dep.

A set of thermal analyses has been conducted to conservatively predict the heat transfer of a graphite crucible. The study used conjugate heat transfer to determine the cooling characteristics of a graphite crucible. Natural convection and conduction through the casting charge and the graphite crucible are examined. All of the analyses were conducted in non-dimensional form up to a Rayleigh number of 1×10^8. The parametric study examined the effect of increasing the internal heat generation of the casting charge. Data derived from an empirical estimate are compared to the FIDAP simulations. The two models are found to have good correlation.

20764 (BNL–52468) **Release of radon contaminants from Yucca Mountain: The role of buoyancy driven flow.** Sullivan, T.M.; Pescatore, C. Brookhaven National Lab., Upton, NY (United States). Feb 1994. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95011521. Source: OSTI; NTIS; INIS; GPO Dep.

The potential for the repository heat source to promote buoyancy driven flow and thereby cause release of radon gas out of Yucca Mountain has been examined through a critical review of the theoretical and experimental studies of this process. The review indicates that steady-state buoyancy enhanced release of natural radon and other contaminant gases should not be a major concern at Yucca Mountain. Barometric pumping and wind pumping are identified as two processes that will have a potentially greater effect on surface releases of gases.

20765 (BNL–52469) **Overview of research and development in subsurface fate and transport modeling.** Sullivan, T.M. (Brookhaven National Lab., Upton, NY (United States)); Chehata, M. Brookhaven National Lab., Upton, NY (United States). May 1995. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012459. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy is responsible for the remediation of over 450 different subsurface-contaminated sites. Contaminant plumes at these sites range in volume from several to millions of cubic yards. The concentration of contaminants also ranges over several orders of magnitude. Contaminants include hazardous wastes such as heavy metals and organic chemicals, radioactive waste including tritium, uranium, and thorium, and mixed waste, which is a combination of hazardous and radioactive wastes. The physical form of the contaminants includes solutes, nonaqueous phase liquids (NAPLs), and vapor phase contaminants such as volatilized organic chemicals and radon. The subject of contaminant fate and transport modeling is multi-disciplinary, involving hydrology, geology, microbiology, chemistry, applied mathematics, computer science, and other areas of expertise. It is an issue of great significance in the United States and around the world. As such, many organizations have substantial programs in this area. In gathering data to prepare this report, a survey was performed of research and development work that is funded by US government agencies to improve the understanding and mechanistic modeling of processes that control contaminant movement through subsurface systems. Government agencies which fund programs that contain fate and transport modeling components include the Environmental Protection Agency, Nuclear Regulatory Commission, Department of Agriculture, Department of Energy, National Science Foundation, Department of Defense, United States Geological Survey, and National Institutes of Health.

20766 (BNL–61648) **An overview of the DOE high-level waste storage tank structural integrity assessment guidelines.** Bandyopadhyay, K.; Bush, S.; Kassir, M.; Mather, B.; Shewmon, P.; Streicher, M.; Thompson, B.; van Rooyen, D.; Weeks, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–38: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95010449. Source: OSTI; NTIS; INIS; GPO Dep.

The basic elements of a structural integrity program for high-level waste storage tanks include identifying significant aging degradation mechanisms, developing programs to monitor and control these degradation processes, and developing management options and procedures to minimize impact on the environment should tank leakage develop. A Waste Tank Structural Integrity Panel (TSIP) was established by Brookhaven National Laboratory at the request

of the DOE Office of Environmental Restoration and Waste Management to review these elements and prepare a set of guidelines that could be used by DOE and its contractors to manage the structural integrity of these tanks. These guidelines emphasize the identification of significant degradation mechanisms for both the steel and concrete components of the tanks, the recommended monitoring and inspection programs, and the indicated management options.

20767 (BNL–61651) **Aging mechanisms for concrete components of High-Level Waste storage tanks.** Kassir, M.; Bandyopadhyay, K.; Bush, S.; Mather, B.; Shewmon, P.; Streicher, M.; Thompson, B.; van Rooyen, D.; Weeks, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–34: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95011403. Source: OSTI; NTIS; INIS; GPO Dep.

The age-related degradation mechanisms which affect the concrete and the reinforcing steel in the high-level waste (HLW) storage tanks art evaluated with respect to their potential significance to the continued performance of the concrete, and am classified into non-significant and potentially significant. The identified potentially significant degradation mechanisms include the effects of elevated temperature, freezing and thawing, leaching of calcium hydroxide, aggressive chemical attack, and corrosion of the reinforcing steel. To the extent that available knowledge permits, these mechanisms are generically evaluated and quantified so that site-specific plans may be developed to verify whether significant degradation has occurred in the concrete, and, if so, to formulate mitigating measures to avoid further deterioration and possibly repair the degradation or pursue other management options.

20768 (CAO–94-1005-Rev.1-Vol.1) **Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory report. Volume 1. Revision 1.** Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div.; USDOE Carlsbad Area Office, NM (United States). Feb 1995. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95009611. Source: OSTI; NTIS; INIS; GPO Dep.

Report includes diskette designed to run on IBM PC or compatible equipment.

This document provides baseline inventories of transuranic wastes for the WIPP facility. Information on waste forms, forecasting of future inventories, and waste stream originators is also provided. A diskette is provided which contains the inventory database.

20769 (CEA-CONF–12006) **Incineration as a radioactive waste volume reduction process for CEA nuclear centers.** Atabek, R.; Chaudon, L. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. d'Exploitation du Retraitement et de Demantelement. 1994. 10p. (CONF-940528–: 13. international symposium on thermal treatment technologies, Houston, TX (United States), 9-13 May 1994). Order Number DE95631534. Source: OSTI; NTIS (US Sales Only); INIS.

Incineration processes represent a promising solution for waste volume reduction, and will be increasingly used in the future. The features and performance specifications of low-level waste incinerators with capacities ranging from 10 to 20 $kg^{-}h^{-1}$ at the Fontenay-aux-Roses, Grenoble and Cadarache nuclear centers in France are briefly reviewed. More extensive knowledge of low-level wastes produced in facilities operated by the Commissariat a l'Energie Atomique (CEA) has allowed us to assess the volume reduction obtained by processing combustible waste in existing incinerators. Research and development work is in progress to improve management procedures for higher-level waste and to build facilities capable of incinerating α - contaminated waste. (authors). 6 refs., 5 figs., 1 tab.

20770 (CEA-CONF–12007) **Vitrification of reactor wastes.** Jouan, A. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Sussmilch, J. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1993. 5p. (CONF-930906–: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE95632473. Source: OSTI; NTIS (US Sales Only); INIS.

The vitrification of low and intermediate level wastes from the NPP operation has been studied in the frame of a Franco-Czech agreement. The laboratory experiments concentrated on a search for a suitable borosilicate glass matrix which could incorporate relatively high quantities of boron and sodium, main components of liquid wastes from the WWER reactor type NPPs. A relatively wide area of waste compositions has been studied and properties of glasses suitable for the technology and waste disposal were measured. Great attention has been paid to the chemical stability (leachability), other properties like thermal dependence of viscosity and electrical conductivity of melts, and the microstructure of the final solidification product have also been evaluated. The feasibility of the vitrification process has been proved during pilot plant tests which were accomplished at the French establishment in Marcoule. The results of tests were promising. (authors). 4 tabs., 7 figs.

20771 (CONF-950209–11) **Use of passive alpha detectors to screen for uranium contamination in a field at Fernald, Ohio.** Dudney, C.S. (Oak Ridge National Lab., TN (United States)); Meyer, K.E.; Gammage, R.B.; Wheeler, R.V.; Salasky, M.; Kotrappa, P. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 22-24 Feb 1995. Order Number DE95013353. Source: OSTI; NTIS; INIS; GPO Dep.

TTP/OR158102.

This paper reports the results from a field test of newly developed techniques for inexpensive, in situ screening of soil for alpha contamination. Passive alpha detectors that are commercially available for the detection indoor airborne alpha activity (i.e., ^{222}Rn) have been modified so they can be applied to the detection of alpha contamination on surfaces or in soils. Results reported here are from an intercomparison involving several different techniques with all measurements being made at the same sites in a field near the formerly used uranium processing facility at Fernald, Ohio, during the summer of 1994. The results for two types of passive alpha detector show that the quality of calibration is improved if soils samples are milled to increase homogeneity within the soil matrices. The correlation between laboratory based radiochemical analyses and quick, field-based screening measurements is acceptable and can be improved if the passive devices are left for longer exposure times in the field. The total cost per measurement for either type of passive alpha detector is probably less than $25 and should provide a cost-effective means for site managers to develop the information needed to find areas with remaining alpha contamination so resources can be allocated efficiently.

20772 (CONF-950570–25) **Mined Geologic Disposal System Concept of Operations.** Heidt, R.M. TRW Environmental Safety Systems, Inc., Las Vegas, NV (United States). 8 Jun 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. From International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995. Order Number DE95012255. Source: OSTI; NTIS; INIS; GPO Dep.

A Concept of Operations has been developed for the disposal of high-level radioactive waste in the potential geologic repository at Yucca Mountain. The Concept of Operations has been developed to document a cormion understanding of how the repository is to be operated. It is based on the repository architecture identified in the Initial Summary Report for Repository/Waste Package Advanced Conceptual Design and describes the operation of the repository from the initial receipt of waste through repository closure. Also described are operations for waste retrieval.

20773 (CONF-950646–18) **Cementitious stabilization of chromium, arsenic, and selenium in a cooling tower sludge.** Spence, R.D. (Oak Ridge National Lab., TN (United States). Chemical Technology Div.); Gilliam, T.M.; Bleier, A. Oak Ridge National Lab., TN (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Air and Waste Management Association

meeting; San Antonio, TX (United States); 18-23 Jun 1995. Order Number DE95012892. Source: OSTI; NTIS; INIS; GPO Dep.

The Federal Facility Compliance Agreement (FFCA) establishes an aggressive schedule for conducting studies and treatment method development under the treatability exclusion of RCRA for those mixed wastes for which treatment methods and capabilities have yet to be defined. One of these wastes is a radioactive cooling tower sludge. This paper presents some results of a treatability study of the stabilization of this cooling tower sludge in cementitious waste forms. The sample of the cooling tower sludge obtained for this study was found to be not characteristically hazardous in regard to arsenic, barium, chromium, lead, and selenium, despite the waste codes associated with this waste. However, the scope of this study included spiking three RCRA metals to two orders of magnitude above the initial concentration to test the limits of cementitious stabilization. Chromium and arsenic were spiked at concentrations of 200, 2,000, and 20,000 mg/kg, and selenium was spiked at 100, 1,000, and 10,000 mg/kg (concentrations based on the metal in the sludge solids). Portland cement, Class F fly ash, and slag were selected as stabilizing agents in the present study. Perlite, a fine, porous volcanic rock commonly used as a filter aid, was used as a water-sorptive agent in this study in order to control bleed water for high water contents. The highly porous perlite dust absorbs large amounts of water by capillary action and does not present the handling and processing problems exhibited by clays used for bleed water control.

20774 (CONF-950646–21) **Chemical oxidation of volatile and semi-volatile organic compounds in soil.** Gates, D.D.; Siegrist, R.L.; Cline, S.R. Oak Ridge National Lab., TN (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Air and Waste Management Association meeting; San Antonio, TX (United States); 18-23 Jun 1995. Order Number DE95013048. Source: OSTI; NTIS; INIS; GPO Dep.

Subsurface contamination with fuel hydrocarbons or chlorinated hydrocarbons is prevalent throughout the Department of Energy (DOE) complex and in many sites managed by the Environmental Protection Agency (EPA) Superfund program. The most commonly reported chlorinated hydrocarbons (occurring > 50% of DOE contaminated sites) were trichloroethylene (TCE), 1, 1, 1,-trichloroethane (TCA), and tetrachloroethylene (PCE) with concentrations in the range of 0.2 μg/kg to 12,000 mg/kg. The fuel hydrocarbons most frequently reported as being present at DOE sites include aromatic compounds and polyaromatic compounds such as phenanthrene, pyrene, and naphthalene. The primary sources of these semi-volatile organic compounds (SVOCs) are coal waste from coal fired electric power plants used at many of these facilities in the past and gasoline spills and leaks. Dense non-aqueous phase liquids (DNAPLs) can migrate within the subsurface for long periods of time along a variety of pathways including fractures, macropores, and micropores. Diffusion of contaminants in the non-aqueous, aqueous, and vapor phase can occur from the fractures and macropores into the matrix of fine-textured media. As a result of these contamination processes, removal of contaminants from the subsurface and the delivery of treatment agents into and throughout contaminated regions are often hindered, making rapid and extensive remediation difficult.

20775 (CONF-950917–9) **Risk-based cleanup and recycling of residuals from United States Department of Energy Decontamination and Decommissioning facilities in Oak Ridge, Tennessee, USA.** DeLozier, F. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. international conference on radioactive waste management and environmental remediation; Berlin (Germany); 3-9 Sep 1995. Order Number DE95010222. Source: OSTI; NTIS; INIS; GPO Dep.

Decontamination and Decommissioning Program activities at United States Department of Energy facilities in Oak Ridge, Tennessee, involve a wide variety of buildings, building materials, and contaminants. There are approximately 100 buildings/structures included in the program, and they are primarily large gaseous diffusion plant buildings (one of which is 170,000 m^2 under roof), several research reactors, chemical and isotope processing facilities, and weapons component production facilities. The major contaminants at these facilities are uranium, mercury, solvents, cesium, strontium, asbestos, polychlorinated biphenyls, and other metals and radionuclides. Many of the buildings assigned to the Decontamination and Decommissioning Program are located on or near contaminated land units that are regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, which prescribes risk-based cleanup. Original decontamination and decommissioning plans assumed free release standards similar to those proposed for power reactors by the United States Nuclear Regulatory Commission. However, now it is being proposed that decontamination and decommissioning work, like other remedial action work at the facilities, be governed by the Comprehensive Environmental Response, Compensation, and Liability Act-based regulatory agreement in place between the Department of Energy, the United States Environmental Protection Agency, and state regulators. It is also proposed that the facilities be cleaned up to a level dictated by the results of health and environmental-based risk assessments and consistent with the land beneath and around the buildings. The major emphasis, with all decontamination and decommissioning work, has been, and will continue to be, placed on recycling metal and other building materials when feasible.

20776 (DOE/AL/62350–151) **Integrated Project Management System description.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1994. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95009832. Source: OSTI; NTIS; INIS; GPO Dep.

The Integrated Program Management System (IPMS) Description is a "working" document that describes the work processes of the Uranium Mill Tailings Remedial Action Project Office (UMTRA) and IPMS Group. This document has undergone many revisions since the UMTRA Project began; this revision not only updates the work processes but more clearly explains the relationships between the Project Office, contractors, and other participants. The work process flow style has been revised to better describe Project work and the relationships of participants. For each work process, more background and guidance on "why" and "what is expected" is given. For example, a description of activity data sheets has been added in the work organization and the Project performance and reporting processes, as well as additional detail about the federal budget process and funding management and improved flow charts and explanations of cost and schedule management. A chapter has been added describing the Cost Reduction/Productivity Improvement Program. The Change Control Board (CCB) procedures (Appendix A) have been updated. Project critical issues meeting (PCIM) procedures have been added as Appendix B. Budget risk assessment meeting procedures have been added as Appendix C. These appendices are written to act as stand-alone documentation for each process. As the procedures are improved and updated, the documentation can be updated separately.

20777 (DOE/EA–0976) **Finding of no significant impact proposed corrective action for the Northeast Site at the Pinellas Plant in Largo, Florida.** Department of Energy, Washington, DC (United States). Div. of Electric Energy Systems. [1995]. 88p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012963. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA) (DOE/EA-0976) of the proposed corrective action for the Northeast Site at the Pinellas Plant in Largo, Florida. The Northeast Site contains contaminated groundwater that would be removed, treated, and discharged to the Pinellas County Sewer System. Based on the analyses in the EA, the DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C.4321 et.seq. Therefore, the preparation of an environmental impact statement is not required and the DOE is issuing this Finding of No Significant Impact (FONSI).

20778 (DOE/EA–0977) **Proposed Actinide Source-Term Waste Test Program, Los Alamos National Laboratory, Los Alamos, New Mexico. Environmental assessment, Revision 7.**

USDOE Los Alamos Area Office, NM (United States). 10 Jan 1995. 59p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012238. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) is a full-scale pilot plant designed to demonstrate the feasibility of long-term management, storage, and disposal of transuranic (TRU) waste from the environment. Environmental Protection Agency (EPA) regulations for disposal systems of transuranic wastes require development of performance assessments to provide a basis for a reasonable expectation that cumulative releases to the accessible environment will not exceed the quantities specified in 40 CFR 191 Subparts 6 and C (EPA 1993). One of the major criteria established by performance assessments is an analysis that estimates the cumulative releases of radionuclides (actinides), considering the associated uncertainties, caused by all significant processes and events. The most likely scenario to cause a release of radionuclides – in this case, the actinide elements thorium through americium – is the inadvertent intrusion of drilling into the waste storage areas. This activity could allow brine, which occurs naturally in pockets in the geological formations that make up the WIPP infrastructure, to enter and contact the salt-encrusted waste containers. Brine coming into contact with the waste containers could eventually cause a breach in the container walls, allowing their actinide content to become available for transport to the accessible environment. This Environmental Assessment (EA) analyzes the proposed action of the Actinide Source-Term Waste Test Program (STTP) as a means of providing data on the behavior of actinide elements in brine to help evaluate WIPP compliance with 40 CFR 191 Subparts B and C. The STTP is designed to measure the concentrations of actinides in actual TRU waste that has been immersed in brine. The proposed action would be a two- to five-year study to measure the concentration of actinides in brine and the composition of effluent gases in the test container as a measure of brine radiolysis and other processes.

20779 (DOE/EA–1039) **Actinide solution processing at the Rocky Flats Environmental Technology Site.** USDOE Rocky Flats Office, Golden, CO (United States). Apr 1995. 97p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012962. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-1039, for radioactive solution removal and processing at Rocky Flats Environmental Technology Site, Golden, Colorado. The proposal for solution removal and processing is in response to independent safety assessments and an agreement with the State of Colorado to remove mixed residues at Rocky Flats and reduce the risk of future accidents. Monthly public meetings were held during the scoping and preparation of the EA. The scope of the EA included evaluations of alternative methods and locations of solution processing. A comment period from February 20, 1995 through March 21, 1995 was provided to the public and the State of Colorado to offer written comment on the EA. Comments were received from the State of Colorado and the U.S. Environmental Protection Agency. A response to the agency comments is included in the Final EA.

20780 (DOE/HWP–153) **Chemometrics review for chemical sensor development, task 7 report.** Oak Ridge National Lab., TN (United States); Advanced Sciences, Inc., Albuquerque, NM (United States). May 1994. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014025. Source: OSTI; NTIS; INIS; GPO Dep.

This report, the seventh in a series on the evaluation of several chemical sensors for use in the U.S. Department of Energy's (DOE's) site characterization and monitoring programs, concentrates on the potential use of chemometrics techniques in analysis of sensor data. Chemometrics is the chemical discipline that uses mathematical, statistical, and other methods that employ formal logic to: design or select optimal measurement procedures and experiments and provide maximum relevant chemical information by analyzing chemical data. The report emphasizes the latter aspect. In a formal sense, two distinct phases are in chemometrics applications to analytical chemistry problems: (1) the exploratory data analysis phase and (2) the calibration and prediction phase. For use in real-world problems, it is wise to add a third aspect - the independent validation and verification phase. In practical applications, such as the ERWM work, and in order of decreasing difficulties, the most difficult tasks in chemometrics are: establishing the necessary infrastructure (to manage sampling records, data handling, and data storage and related aspects), exploring data analysis, and solving calibration problems, especially for nonlinear models. Chemometrics techniques are different for what are called zeroth-, first-, and second-order systems, and the details depend on the form of the assumed functional relationship between the measured response and the concentrations of components in mixtures. In general, linear relationships can be handled relatively easily, but nonlinear relationships can be difficult.

20781 (DOE/OR/21921–T2) **Grout for closure of the demonstration vault at the US DOE Hanford Facility. Final report.** Wakeley, L.D.; Ernzen, J.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab. Aug 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90OR21921. (SL–92-21). Order Number DE95011452. Source: OSTI; NTIS; INIS; GPO Dep.

The Waterways Experiment Station (WES) developed a grout to be used as a cold- (nonradioactive) cap or void-fill grout between the solidified low-level waste and the cover blocks of a demonstration vault for disposal of phosphate-sulfate waste (PSW) at the US Department of Energy (DOE) Hanford Facility. The project consisted of formulation and evaluation of candidate grouts and selection of the best candidate grout, followed by a physical scale-model test to verify grout performance under project-specific conditions. Further, the project provided data to verify numerical models (accomplished elsewhere) of stresses and isotherms inside the Hanford demonstration vault. Evaluation of unhardened grout included obtaining data on segregation, bleeding, flow, and working time. For hardened grout, strength, volume stability, temperature rise, and chemical compatibility with surrogate wasteform grout were examined. The grout was formulated to accommodate unique environmental boundary conditions (vault temperature = 45 C) and exacting regulatory requirements (mandating less than 0.1% shrinkage with no expansion and no bleeding); and to remain pumpable for a minimum of 2 hr. A grout consisting of API Class H oil-well cement, an ASTM C 618 Class F fly ash, sodium bentonite clay, and a natural sand from the Hanford area met performance requirements in laboratory studies. It is recommended for use in the DOE Hanford demonstration PSW vault.

20782 (DOE/OSTI–3406(Suppl.4)(Add.2)) **Yucca Mountain Site Characterization Project Bibliography, July, December 1994: An update.** USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). Mar 1995. 76p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95005302. Source: OSTI; NTIS; INIS; GPO Dep.

Following a reorganization of the Office of Civilian Radioactive Waste Management in 1990, the Yucca Mountain Project was renamed Yucca Mountain Site Charactrization Project. The title of this bibliography was also changed to Yucca Mountain Site Characterization Project Bibliography. Prior to August 5, 1988, this project was called the Nevada Nuclear Waste Storage Investigations. This bibliography contains information on this ongoing project that was added to the Department of Energy's Science and Technology Database from July 1, 1994 through December 31, 1994. The bibliography is categorized by principal project participating organization. Participant-sponsored subcontractor reports, papers, and articles are included in the sponsoring organization's list. Another section contains information about publications on the Energy Science and Technology Database that were not sponsored by the project but have some relevance to it.

20783 (DOE/RL–95-15) **1995 Report on Hanford site land disposal restrictions for mixed waste.** Black, D.G. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 252p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011574. Source: OSTI; NTIS; INIS; GPO Dep.

This report was submitted to meet the requirements of Hanford Federal Facility Agreement and Consent Order Milestone M-26-01E. This milestone requires the preparation of an annual report that covers characterization, treatment, storage, minimization, and

other aspects of land disposal restricted mixed waste at the Hanford Site. The U.S. Department of Energy, its predecessors, and contractors at the Hanford Site were involved in the production and purification of nuclear defense materials from the early 1940s to the late 1980s. These production activities have generated large quantities of liquid and solid radioactive mixed waste. This waste is subject to regulation under authority of both the Resource Conservation and Recovery Act of 1976 and Atomic Energy Act of 1954. This report covers mixed waste only. The Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy have entered into an agreement, the Hanford Federal Facility Agreement and Consent Order (commonly referred to as the Tri-Party Agreement) to bring the Hanford Site operations into compliance with dangerous waste regulations. The Tri-Party Agreement required development of the original land disposal restrictions (LDRs) plan and its annual updates to comply with LDR requirements for radioactive mixed waste. This report is the fifth update of the plan first issued in 1990. Tri-Party Agreement negotiations completed in 1993 and approved in January 1994 changed and added many new milestones. Most of the changes were related to the Tank Waste Remediation System and these changes are incorporated into this report.

20784 (DOE/RL–364162-1-Vol.4) **Solid Waste Operations Complex W-113: Project cost estimate. Preliminary design report. Volume IV.** Westinghouse Hanford Co., Richland, WA (United States). Jan 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Subcontract MJJ-SVV-364162. Order Number DE95010981. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains Volume IV of the Preliminary Design Report for the Solid Waste Operations Complex W-113 which is the Project Cost Estimate and construction schedule. The estimate was developed based upon Title 1 material take-offs, budgetary equipment quotes and Raytheon historical in-house data. The W-113 project cost estimate and project construction schedule were integrated together to provide a resource loaded project network.

20785 (DOE/WIPP–95-1090) **Waste Isolation Pilot Plant remote-handled transuranic waste disposal strategy.** USDOE Carlsbad Area Office, NM (United States). 31 Mar 1995. 41p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012516. Source: OSTI; NTIS; INIS; GPO Dep.

The remote-handled transuranic (RH-TRU) waste disposal strategy described in this report identifies the process for ensuring that cost-effective initial disposal of RH-TRU waste will begin in Fiscal Year 2002. The strategy also provides a long-term approach for ensuring the efficient and sustained disposal of RH-TRU waste during the operating life of WIPP. Because Oak Ridge National Laboratory stores about 85 percent of the current inventory, the strategy is to assess the effectiveness of modifying their facilities to package waste, rather than constructing new facilities. In addition, the strategy involves identification of ways to prepare waste at other sites to supplement waste from Oak Ridge National Laboratory. DOE will also evaluate alternative packagings, modes of transportation, and waste emplacement configurations, and will select preferred alternatives to ensure initial disposal as scheduled. The long-term strategy provides a systemwide planning approach that will allow sustained disposal of RH-TRU waste during the operating life of WIPP. The DOE's approach is to consider the three relevant systems – the waste management system at the generator/storage sites, the transportation system, and the WIPP disposal system – and to evaluate the system components individually and in aggregate against criteria for improving system performance. To ensure full implementation, in Fiscal Years 1996 and 1997 DOE will: (1) decide whether existing facilities at Oak Ridge National Laboratory or new facilities to package and certify waste are necessary; (2) select the optimal packaging and mode of transportation for initial disposal; and (3) select an optimal disposal configuration to ensure that the allowable limits of RH-TRU waste can be disposed. These decisions will be used to identify funding requirements for the three relevant systems and schedules for implementation to ensure that the goal of initial disposal is met.

20786 (DOE/WIPP–95-2092) **Waste Isolation Pilot Plant borehole data.** Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. Apr 1995. 340p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95012971. Source: OSTI; NTIS; INIS; GPO Dep.

Data pertaining to all the surface boreholes used at the WIPP site for site characterization hydrological testing and resource evaluation exist in numerous source documents. This project was initiated to develop a comprehensive data base that would include the data on all WIPP related surface boreholes from the Atomic Energy Commission, Waste Isolation Pilot Plant Energy Research and Development Administration, Department of Energy, and Hydrologic Test Borehole Programs. The data compiled from each borehole includes: operator, permit number, location, total depth, type of well, driller, drilling record, casing record, plugging schedule, and stratigraphic summary. There are six groups of boreholes contained in this data base, they are as follows: Commercially Drilled Potash Boreholes, Energy Department Wells, Geologic Exploration Boreholes, Hydrologic Test Boreholes, Potash Boreholes, and Subsurface Exploration Boreholes. There were numerous references which contained borehole data. In some cases the data found in one document was inconsistent with data in another document. In order to ensure consistency and accuracy in the data base, the same references were used for as many of the boreholes as possible. For example, all elevations and locations were taken from Compilation and Comparison of Test-Hole Location Surveys in the Vicinity of the WIPP Site. SAND 88-1065, Table 3-5. There are some sections where a data field is left blank. In this case, the information was either not applicable or was unavailable.

20787 (DUN–5200-RD) **Waste management plans.** Corbit, C.D.; Geier, R.G. Douglas United Nuclear, Inc., Richland, WA (United States). 9 Dec 1968. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012639. Source: OSTI; NTIS; GPO Dep.

Douglas United Nuclear, Inc., operates for the AEC at the Hanford reservation four production reactors and their fuel preparation facilities. The production reactor plants are located on the south bank of the Columbia River approximately 30 miles northwest of Richland. The fuel preparation plants, located about 5 miles north of Richland are also on the Columbia River. This report provides identification of such facility; a brief description of functions and environs; and schematic diagrams of processes which generate radioactive wastes. A discussion of process characteristics which determine quantity and quality of wastes is provided.

20788 (INIS-mf–15112) **Conditions governing the acceptance of radioactive wastes by the Hauptabteilung Dekontaminationsbetriebe (HDB). Full text of legal provisions, issue no.6 of July 1, 1991, as amended until January 1, 1995.** Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). 1995. 69p. (In German). Order Number DE95785652. Source: OSTI; NTIS (US Sales Only); INIS.

With separate price list.

The conditions apply to the acceptance of radwaste by the Main Decontamination Dept. (HDB) of Karlsruhe Research Center, including radioactive remnants, contaminated plant components, and primary waste from the following waste generators: Institutes of the Karlsruhe Research Center, facilities located within the Center but run by other organisations, other outside facilities not linked with the Center, as e.g. waste generators in Baden-Wuerttemberg obliged to deliver their radwaste to the Radwaste Collecting Site of the Land of Baden-Wuerttemberg. Amendments are marked at the right-hand margin of the text.

20789 (LA–12779-MS) **Colloid-facilitated radionuclide transport at Yucca Mountain.** Triay, I. (Los Alamos National Lab., NM (United States)); Levy, S.; Robinson, B.; Simmons, A.; Nelson, S.; Nuttall, H.; Steinkampf, W.; Viani, B. Los Alamos National Lab., NM (United States). Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010558. Source: OSTI; NTIS; GPO Dep.

The objective of this report is to describe the colloid investigations within the Yucca Mountain Site Characterization Project (YMP) to evaluate whether colloids will significantly increase radionuclide release from a potential high-level nuclear waste repository at Yucca Mountain to the accessible environment. The

evidence of the existence of colloids from sampling studies and observation of colloid transport at the field scale are reviewed. The relevance of colloid transport laboratory and field experiments to the conditions at Yucca Mountain are discussed. Research needs are identified in the areas of colloid sampling, colloid generation, colloid stability, colloidal sorption/desorption of radionuclides, and colloid migration. The colloid transport calculations that will allow evaluation of the data to assess the importance of colloid-facilitated radionuclide transport at Yucca Mountain are presented.

20790 (LA–12886-MS) **Plutonium carbonate speciation changes as measured in dilute solutions with photoacoustic spectroscopy: Yucca Mountain Site Characterization Program Milestone report 3350.** Tait, C.D.; Ekberg, S.A.; Palmer, P.D.; Morris, D.E. Los Alamos National Lab., NM (United States). May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012118. Source: OSTI; NTIS; INIS; GPO Dep.

The stability fields for dilute Pu-carbonate species versus pH (8.4 to 12.0) and total carbonate concentrations (3 mM to 1.0 M) have been mapped-out using photoacoustic absorption spectroscopy (PAS). At least four different plutonium species, characterized by absorption peaks at 486, 492, 500, and 513 rim, have been found. A redox change to a Pu(VI) complex can not account for the speciation change associated with the first two spectra (486 and 492 nm peaks). Moreover, the data are consistent with what is predicted from a previous YMP milestone. This previous study was performed under very different conditions of plutonium concentration and carbonate/pH changes, and extension of these conditions to much lower Pu concentrations and to more neutral pHs was made possible with PAS spectroscopy. These new results reinforce the previous results by extending the range of direct observation and by eliminating other possibilities such as dimerization/polymerization reactions. As bicarbonate concentration is increased from .01 M to 1.0 M at pH=8.4 to 8.9, predominately $[Pu(OH)_{x+1}(CO_3)_y]^{4-(x+2y)}$ (492 nm peak) is converted to $[Pu(OH)_x(CO_3)_{y+1}]^{4-(x+2y+2)}$ (486 nm peak). The starting stoichiometry (x and y values) remain undetermined, but the effect of ionic strength and temperature indicate that the 486 nm species is highly charged, and therefore $x+2y \geq 3$. The temperature effect on the equilibrium between these two species was also investigated, with the species giving rise to the 486 nm peak reversibly losing importance at elevated (50 and 75°C temperatures).

20791 (LA–12907) **Pit-storage monitoring.** Buntain, G. (and others); Matsumoto, K.; Steinke, R. Los Alamos National Lab., NM (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010559. Source: OSTI; NTIS; GPO Dep.

Plutonium Pits retrieved during the dismantlement of nuclear weapons are presently being stored in earth-covered magazines in Zone 4 at the Pantex plant in Amarillo, Texas. Delays in the development and certification of an approved long-term storage facility indicate that these pits are likely to remain at Pantex for the foreseeable future. Because these magazines are not protected by any environmental control systems and because the number of pits per magazine is high, temperatures within the magazines can, and sometimes do, rise to temperatures higher than optimum for pit storage. Scientists from Los Alamos and Lawrence Livermore national laboratories, as well as from the Pantex plant, operated by Mason & Hanger, have collaborated to design a joint modeling/experimental program that will enable scientists to understand heat-flow phenomena in pit-storage magazines. Our efforts have focused on developing the capability to predict temperatures of stored pits. We are using environmental information gathered primarily from the Pantex pit-storage facility to develop empirical predictive tools as well as three-dimensional heat-flow models.

20792 (LA–12928-MS) **In-place HEPA filter testing summary (1993).** Martinez, V.A.; Helland, G.D. Los Alamos National Lab., NM (United States). Apr 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010556. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the latest in a series of annual reports regarding the in-place testing program for highly efficient filtration systems at Los Alamos National Laboratory. This testing is conducted to maintain regulatory permits and verify the performance levels of these filtration systems have not deteriorated over the last operating cycle. In-place testing is also conducted on systems when maintenance and/or repair to the filtration system have been performed to verify that the system components have been installed correctly and there has been no damage to the filter media. Performance testing of negative air pressure machines and HEPA filtered vacuums has been included as part of the decontamination and decommissioning activities and the asbestos management program at Los Alamos National Laboratory. This report provides a brief overview of the testing procedures used to conduct in-place tests, a summary of individual system performance, and trends observed since the previous year.

20793 (LA–12936-MS) **Tank SY-102 remediation project summary report: ASPEN modeling.** Punjak, W.A.; Schreiber, S.B.; Yarbro, S.L. Los Alamos National Lab., NM (United States). May 1995. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012116. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy established the Tank Waste Remediation System (TWRS) to safely manage and dispose of radioactive waste stored in underground tanks on the Hanford Site. As a part of this program, personnel at Los Alamos National Laboratory (LANL) have developed and demonstrated a flow sheet to remediate tank SY-102, which is located in the 200 West Area and contains high-level radioactive waste. In the conceptual design report issued earlier, an ASPEN plus™ computer model of the flow sheet was presented. This report documents improvements in the flow sheet model after additional thermodynamic data for the actinide species were incorporated.

20794 (LA–12943) **Effects of soluble organic complexants and their degradation products on the removal of selected radionuclides from high-level waste. Part II: Distributions of Sr, Cs, Tc, and Am onto 32 absorbers from four variations of Hanford tank 101-SY simulant solution.** Marsh, S.F. (Sandia National Labs., Albuquerque, NM (United States)); Svitra, Z.V.; Bowen, S.M. Los Alamos National Lab., NM (United States). Apr 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95013479. Source: OSTI; NTIS; INIS; GPO Dep.

Many of the radioactive waste storage tanks at U.S. Department of Energy facilities contain organic compounds that have been degraded by radiolysis and chemical reactions during decades of storage. In this second part of our three-part investigation of the effects of soluble organic complexants and their degradation products, we measured the sorption of strontium, cesium, technetium, and americium onto 32 absorbers that offer high sorption of these elements in the absence of organic complexants. The four solutions tested were (1) a simulant for a 3:1 dilution of Hanford Tank 101-SY contents that initially contained ethylenediaminetetraacetic acid (EDTA), (2) this simulant after gamma-irradiation to 34 Mrads, (3) the unirradiated simulant after treatment with a hydrothermal organic-destruction process, and (4) the irradiated simulant after hydrothermal processing. For each of 512 element/absorber/solution combinations, we measured distribution coefficients (Kds) twice for each period for dynamic contact periods of 30 min, 2 h, and 6 h to obtain information about sorption kinetics. On the basis of our 3,072 measured Kd values, the sorption of strontium and americium is significantly decreased by the organic components of the simulant solutions, whereas the sorption of cesium and technetium appears unaffected by the organic components of the simulant solutions.

20795 (LA–12949-MS) **Discriminators for the Accelerator-Based Conversion (ABC) concept using a subcritical molten salt system.** Arthur, E.; Busksa, J.; Davidson, W.; Poston, D. Los Alamos National Lab., NM (United States). May 1995. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012988. Source: OSTI; NTIS; INIS; GPO Dep.

Discriminators are described that quantify enhancements added to plutonium destruction and/or nuclear waste transmutation systems through use of an accelerator/fluid fuel combination. This

combination produces a robust and flexible nuclear system capable of the destruction of all major long-lived actinides (including plutonium) and fission products. The discriminators discussed in this report are (1) impact of subcritical operation on safety, (2) impact of subcritical and fluid fuel operation on plutonium burnout scenarios, and (3) neutron economy enhancements brought about by subcritical operation. Neutron economy enhancements are quantified through assessment of long-term dose reduction resulting from transmutation of key fission products along with relaxation of processing frequencies afforded by subcritical operation.

20796 (LA-SUB–95-36-Vol.3) **Computer Applications Group Inc., Final report FY93 and FY94. Volume 3.** Los Alamos National Lab., NM (United States); Computer Applications Group, Inc., Carlton, OR (United States). 15 Dec 1994. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95013478. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents data pertaining to the geologic mapping of the Yucca Mountain Exploratory Studies facility. Topics discussed include; investigation plans, investigation controls, order of performing multiple investigations, and references to the design requirements of the exploratory studies facility.

20797 (LA-SUB–95-41) **Kinetic measurements on the silicates of the Yucca Mountain potential repository. [Final report], January–September 1994.** Barnes, H.L. (Los Alamos National Lab., NM (United States)); Wilkin, R.T. Los Alamos National Lab., NM (United States); Pennsylvania State Univ., University Park, PA (United States). 25 Aug 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012085. Source: OSTI; NTIS; INIS; GPO Dep.

The principal effort has been concentrated on the preparation of clean clinoptilolite, quartz, and boehmite and then reaction of the natural clinoptilolite solid solution to the Naendmember, plus measurements of the endmember solubility to derive an accurate equilibrium constant for the clinoptilolite dissolution reaction, correctly speciated. We are very pleased with the consistency between the best calorimetrically measured and modeled equilibrium constants and those we have determined from 125°C to 265°C. These results now provide a basis for relating measurements of reaction rates to departures from equilibrium.

20798 (LA-UR–95-252) **A process for treating uranium chips and turnings.** Dziewinska, K. (Los Alamos National Lab., NM (United States)); Lussiez, G.; Munger, D. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950917–5: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006270. Source: OSTI; NTIS; INIS; GPO Dep.

Depleted uranium (DU) chips and turnings are generated during machining of uranium metal. Because high surface area uranium is pyrophoric, the turnings are subject to spontaneous ignition in air. The oxidation of uranium to $U0_2$ and U_30_8 is highly exothermic and therefore the reaction may be self-sustaining. A uranium fire or even rapid oxidation and thermal convection currents will cause emission of radioactive uranium oxides. In the presence of water as liquid or vapor, uranium may also oxidize into $U0_2$ and U_30_8 with generation of hydrogen, a flammable and explosive gas. The heat generated the water reaction may ignite the uranium or hydrogen producing a fire, explosion, or convection current resulting in some uranium oxide becoming airborne. Because the high surface area uranium has the hazardous characteristic of reactivity, it is stored immersed in diesel oil preventing contact with water or air. Los Alamos National Laboratory (LANL) has developed and constructed a process to remove the reactivity characteristic by oxidizing uranium metal to an inert product. This inert form can then be landfilled as a low-level waste. The treatment process consists of draining the packing oils, treating with sodium hypochlorite to wet-oxidize the DU to uranyl hydroxide ($UO_2(OH)_2$), using sodium thiosulfate to reduce the ($UO_2(OH)2$) to $U0_2$, neutralizing with sodium hydroxide, and stabilizing the settled slurry in a cement matrix. The neutralized waste water is consumed at a radioactive waste water treatment facility. Studies done at LANL describe a manageable oxidation rate well within safe bounds.

20799 (LA-UR–95-254) **A process for treating radioactive water-reactive wastes.** Dziewinski, J. (Los Alamos National Lab., NM (United States)); Lussiez, G.; Munger, D. Los Alamos National Lab., NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950917–4: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006269. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos National Laboratory and other locations in the complex of experimental and production facilities operated by the United States Department of Energy (DOE) have generated an appreciable quantity of hazardous and radioactive wastes. The Resource Conservation and Recovery Act (RCRA) enacted by the United States Congress in 1976 and subsequently amended in 1984, 1986, and 1988 requires that every hazardous waste must be rendered nonhazardous before disposal. Many of the wastes generated by the DOE complex are both hazardous and radioactive. These wastes, called mixed wastes, require applying appropriate regulations for radioactive waste disposal and the regulations under RCRA. Mixed wastes must be treated to remove the hazardous waste component before they are disposed as radioactive waste. This paper discusses the development of a treatment process for mixed wastes that exhibit the reactive hazardous characteristic. Specifically, these wastes react readily and violently with water. Wastes such as lithium hydride (LiH), sodium metal, and potassium metal are the primary wastes in this category.

20800 (LA-UR–95-255) **A process for treatment of mixed waste containing chemical plating wastes.** Anast, K.R.; Dziewinski, J.; Lussiez, G. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950917–3: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006267. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Treatment and Minimization Group at Los Alamos National Laboratory has designed and will be constructing a transportable treatment system to treat low-level radioactive mixed waste generated during plating operations. The chemical and plating waste treatment system is composed of two modules with six submodules, which can be trucked to user sites to treat a wide variety of aqueous waste solutions. The process is designed to remove the hazardous components from the waste stream, generating chemically benign, disposable liquids and solids with low level radioactivity. The chemical and plating waste treatment system is designed as a multifunctional process capable of treating several different types of wastes. At this time, the unit has been the designated treatment process for these wastes: Destruction of free cyanide and metal-cyanide complexes from spent plating solutions; destruction of ammonia in solution from spent plating solutions; reduction of Cr^{VI} to Cr^{III} from spent plating solutions, precipitation, solids separation, and immobilization; heavy metal precipitation from spent plating solutions, solids separation, and immobilization, and acid or base neutralization from unspecified solutions.

20801 (LA-UR–95-256) **Electrochemical treatment of mixed (hazardous and radioactive) wastes.** Dziewinski, J.; Zawodzinski, C.; Smith, W.H. Los Alamos National Lab., NM (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950917–2: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006268. Source: OSTI; NTIS; INIS; GPO Dep.

Electrochemical treatment technologies for mixed hazardous waste are currently under development at Los Alamos National Laboratory. For a mixed waste containing toxic components such as heavy metals and cyanides in addition to a radioactive component, the toxic components can be removed or destroyed by electrochemical technologies allowing for recovery of the radioactive component prior to disposal of the solution. Mixed wastes with an organic component can be treated by oxidizing the organic compound to carbon dioxide and then recovering the radioactive

component. The oxidation can be done directly at the anode or indirectly using an electron transfer mediator. This work describes the destruction of isopropanol, acetone and acetic acid at greater than 90% current efficiency using cobalt +3 or silver +2 as the electron transfer mediator. Also described is the destruction of cellulose based cheesecloth rags with electrochemically generated cobalt +3, at an overall efficiency of approximately 20%.

20802 (LA-UR–95-331) **Reclamation of greater than Class C sealed sources at the Los Alamos National Laboratory.** Behrens, R.G.; Jones, S.W. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950917–6: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006277. Source: OSTI; NTIS; INIS; GPO Dep.

One of the important overriding themes of the Los Alamos National Laboratory as a world-class scientific institution is to utilize its expertise in enhancing the long-term welfare of society by minimizing negative side effects of nuclear technology over the past five decades. The Los Alamos National Laboratory is therefore committed to the use of its technical competencies and nuclear facilities, developed through programs in the areas of defense and civilian nuclear research, to support activities which will benefit the United States as a whole. As such, this paper discusses the organizational details and requirements of the Neutron Source Reclamation Program at Los Alamos. This program has as its mission the retrieval, interim storage, and chemical reprocessing of ^{238}PuBe, ^{239}PuBe and ^{241}AmBe neutron sources residing in the hands of private companies and industries, academic institutions, and various state and Federal government agencies.

20803 (LA-UR–95-1270) **Waste site characterization through digital analysis of historical aerial photographs at Los Alamos National Laboratory and Eglin Air Force Base.** Van Eeckhout, E.; Pope, P.; Wells, B.; Rofer, C.; Martin, B. Los Alamos National Lab., NM (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9505205–2: 5. major Range and Test Facility Base environmental workshop, Alexandria, VA (United States), 23-25 May 1995). Order Number DE95012075. Source: OSTI; NTIS; INIS; GPO Dep.

Historical aerial photographs are used to provide a physical history and preliminary mapping information for characterizing hazardous waste sites at Los Alamos National Laboratory and Eglin Air Force Base. The examples cited show how imagery was used to accurately locate and identify previous activities at a site, monitor changes that occurred over time, and document the observable of such activities today. The methodology demonstrates how historical imagery (along with any other pertinent data) can be used in the characterization of past environmental damage.

20804 (LA-UR–95-1509) **A versatile, high-power proton linac for accelerator driven transmutation technologies.** Billen, J.H.; Nath, S.; Stovall, J.E.; Takeda, H.; Wood, R.L.; Young, L.M. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–109: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011986. Source: OSTI; NTIS; INIS; GPO Dep.

We are applying the new coupled-cavity drift-tube linac (CCDTL) to a conceptual design of a high-current, CW accelerator for transmutation applications. A 350-MHz RFQ followed by 700–MHz structures accelerates a 100-mA proton beam to I GeV. Several advantages stem from four key features: (1) a uniform focusing lattice from the start of the CCDTL at about 7 MeV to the end of the linac, (2) external location and separate mechanical support of the electromagnetic quadrupole magnets, (3) very flexible modular physics design and mechanical implementation, and (4) compact, high-frequency structures. These features help to reduce beam loss and, hence, also reduce potential radioactivation of the structure. They result in easy alignment, fast serviceability, and high beam availability. Beam funneling, if necessary, is possible at any energy after the RFQ.

20805 (LBL–36386) **Two-phase flow in regionally saturated fractured rock near excavations.** Geller, J.T. (Lawrence Berkeley Lab., CA (United States). Earth Sciences Div.); Doughty, C.; Long, J.C.S. Lawrence Berkeley Lab., CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950570–22: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95012357. Source: OSTI; NTIS; INIS; GPO Dep.

Hydrologic characterization for potential nuclear waste repositories relies upon data obtained from testing in excavations. The Simulated Drift Experiment in the Stripa Mine in Sweden, a fractured granitic formation below the water table, investigated excavation effects on hydrologic response. Measured water inflow to the drift at atmospheric pressure was nine times less than the value predicted from the inflow to boreholes with pressure held at 2.7 bars. This flow reduction may be due to dissolved gas that comes out of solution at pressures below 2.7 bars, creating a two-phase regime. To investigate this possibility, theoretical studies of flow through fractures when the water is super-saturated with respect to dissolved gas are carried out, using a simple analytical solution followed by a numerical model which relaxes some of the simplifying assumptions. Laboratory experiments that simulate degassing in transparent fracture replicas are conducted to test the assumptions used in the theoretical studies.

20806 (LBL–36872) **Applications of TOUGH2 to infiltration of liquids in media with strong heterogeneity.** Pruess, K.; Antunez, E. Lawrence Berkeley Lab., CA (United States). Feb 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9503116–7: 1995 TOUGH workshop, Berkeley, CA (United States), 20-22 Mar 1995). Order Number DE95012392. Source: OSTI; NTIS; GPO Dep.

Much hydrogeological research during the last decade has focused on the heterogeneity of natural geologic media on different scales. Most of this work has dealt with flow and transport in single-phase, isothermal conditions. The present paper is concerned with multiphase and nonisothermal flows in strongly heterogeneous media. A primary driver of our studies is the hydrogeological system at Yucca Mountain, which is currently being evaluated by the Department of Energy for its suitability as the site of the first geologic repository for civilian high-level nuclear wastes in the US Yucca Mountain is located in the and Southwest, near the Nevada-California border. Going from large scale to small, formation heterogeneities at Yucca Mountain include (i) alternating tilting layers of welded and non-welded tuffs with different matrix permeability and variable degree of fracturing, (ii) major fault systems, (iii) well-connected and permeable fracture networks in low-permeability rocks, and (iv) individual fractures with highly variable apertures.

20807 (LLNL–95012992) **Bibliography of Yucca Mountain Project (YMP) publications at Lawrence Livermore National Laboratory, September 1977–December 1994.** Lawrence Livermore National Lab., CA (United States). Jan 1995. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012992. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of a listing of research projects pertaining to the Yucca Mountain project.

20808 (NUREG/CR–6256-Vol.1) **Field lysimeter investigations - test results. Low-level waste data base development program: Test results for fiscal years 1986, 1987, 1988, and 1989.** McConnell, J.W. Jr.; Rogers, R.D.; Findlay, M.W.; Davis, E.C.; Jastrow, J.D.; Neilson, R.M. Jr.; Hilton, L.D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Lockheed Idaho Technologies Co., Idaho Falls, ID (United States). May 1995. 133p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-94ID13223. (INEL–95/0073-Vol.1). Source: OSTI; NTIS; GPO; INIS.

The Field Lysimeter Investigations: Low-Level Waste Data Base Development Program, funded by the U.S. Nuclear Regulatory Commission (NRC), is (a) studying the degradation effects in EPICOR-II organic ion-exchange resins caused by radiation, (b) examining the adequacy of test procedures recommended in the

Branch Technical Position on Waste Form to meet the requirements of 10 CFR 61 using solidified EPICOR-II resins, (c) obtaining performance information on solidified EPICOR-II ion-exchange resins in a disposal environment, and (d) determining the condition of EPICOR-II liners. Results of the first 4 years of data acquisition from the field testing are presented and discussed. During the continuing field testing, both Portland type I-II cement and Dow vinyl ester-styrene waste forms are being tested in lysimeter arrays located at Argonne National Laboratory-East in Illinois and at Oak Ridge National Laboratory. The experimental equipment is described and results of waste form characterization using tests recommended by the NRC's "Technical Position on Waste Form" are presented. The study is designed to provide continuous data on nuclide release and movement, as well as environmental conditions, over a 20-year period.

20809 (ORNL/ER–299) **Site characterization summary report for Waste Area Grouping 10 Wells at the Old Hydrofracture Facility, Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Mar 1995. 503p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012486. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, is operated for the Department of Energy (DOE) by Martin Marietta Energy Systems (Energy Systems). As part of its DOE mission, ORNL has pioneered waste disposal technologies throughout the years of site operations since World War II. In the late 1950s, efforts were made to develop a permanent disposal alternative to the surface impoundments at ORNL at the request of the National Academy of Sciences. One such technology, the hydrofracture process, involved forming fractures in an underlying geologic host formation (a low-permeability shale) at depths of up to 1000 ft and subsequently injecting a grout slurry containing low-level liquid waste, cement, and other additives at an injection pressure of about 2000 psi. The objective of the effort was to develop a grout slurry that could be injected as a liquid but would solidify after injection, thereby immobilizing the radioisotopes contained in the low-level liquid waste. The scope of this site characterization was the access, sampling, logging, and evaluation of observation wells near the Old Hydrofracture Facility (OHF) in preparation for plugging, recompletion, or other final disposition of the wells.

20810 (ORNL/TM–12105) **Update of the management strategy for Oak Ridge National Laboratory Liquid Low-Level Waste.** Robinson, S.M.; Abraham, T.J.; DePaoli, S.M.; Walker, A.B. Oak Ridge National Lab., TN (United States). Apr 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011626. Source: OSTI; NTIS; INIS; GPO Dep.

The strategy for management of the Oak Ridge National Laboratory's (ORNL) radioactively contaminated liquid waste was reviewed in 1991. The latest information available through the end of 1990 on waste characterization, regulations, US Department of Energy (DOE) budget guidance, and research and development programs was evaluated to determine how the strategy should be revised. Few changes are needed to update the strategy to reflect new waste characterization, research, and regulatory information. However, recent budget guidance from DOE indicates that minimum funding will not be sufficient to accomplish original objectives to upgrade the liquid low-level waste (LLLW) system to comply with the Federal Facilities Agreement, provide long-term LLLW treatment capability, and minimize environmental, safety, and health risks. Options are presented that might allow the ORNL LLLW system to continue operations temporarily, but they would significantly reduce its capabilities to handle emergency situations, provide treatment for new waste streams, and accommodate waste from the Environmental Restoration Program and from decontamination and decommissioning of surplus facilities. These options are also likely to increase worker radiation exposure, risk of environmental insult, and generation of solid waste for on-site and off-site disposal/storage beyond existing facility capacities. The strategy will be fully developed after receipt of additional guidance. The proposed budget limitations are too severe to allow ORNL to meet regulatory requirements or continue operations long term.

20811 (ORNL/TM–12903) **Evaluation of improved techniques for the removal of ^{90}Sr and ^{137}Cs from process wastewater and groundwater: Chabazite zeolite baseline study.** Bostick, D.T.; Arnold, W.D. Jr.; Taylor, P.A.; McTaggart, D.R.; Burgess, M.W.; Guo, B. Oak Ridge National Lab., TN (United States). Apr 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011627. Source: OSTI; NTIS; INIS; GPO Dep.

Standard waste treatment procedures for the removal of ^{90}Sr and ^{137}Cs from contaminated groundwater and process wastewaters generate large volumes of secondary contaminated wastes. Several new sorbent materials, ion exchangers, and other processes hold the promise of treating large volumes of contaminated water while minimizing the generation of secondary low-level radioactive wastes. As part of the Efficient Separations/Processes-Integrated Program (ESPIP), these new treatment techniques will be compared with standard processes to define their effectiveness for the removal of radioactive strontium (Sr) and cesium (Cs), as well as to gauge the quantity of secondary radioactive waste generated by the new processes. This report summarizes the efforts made to design standardized testing procedures to evaluate the sorption characteristics of a baseline wastewater treatment technique. Definition of the experimental procedures, as well as a summary of the benchmark sorption technique, will provide the framework with which to compare newly evolving treatment technologies. Accomplishments include selecting the feed strewn to the Process Waste Treatment Plant (PWTP) at Oak Ridge National Laboratory as representative of the prototypical contaminated wastewater of many DOE sites. Samples from the PWTP feed stream were collected and analyzed for metals, anions, total Sr and Cs, radioactive Sr and Cs, alkalinity, pH, and density. The cumulative sample data were used to formulate a simulant that will be used as a standard waste surrogate for comparative testing of selected treatment methods.

20812 (ORNL/TM–12926) **Strategic Environmental Research and Development Project FY 1994: Assessing national remote sensing technologies for use in US Department of Energy Environmental Restoration Activities, Oak Ridge Solid Waste Storage Area 4 case study.** King, A.L.; Smyre, J.L.; Evers, T.K. Oak Ridge National Lab., TN (United States). Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95008962. Source: OSTI; NTIS; INIS; GPO Dep.

During FY 1994, the Oak Ridge Environmental Restoration (ER) Remote Sensing Program teamed with members of the Oak Ridge National Security Program Office (NSPO), the Environmental Research Institute of Michigan (ERIM) under contract to the National Exploitation Laboratory (NEL), the Oak Ridge Waste Area Group 4 (WAG 4) ER Program, and the US Department of Energy (DOE), Offices of Technology Development, Nonproliferation and National Security, and Environmental Restoration, to conduct a test and demonstration of the uses of national remote sensing technologies at DOE hazardous waste sites located in Oak Ridge, Tennessee. Objectives of the Oak Ridge study were to determine if national remote sensing technologies are useful in conducting prescreening, characterization, and/or monitoring activities to expedite the clean-up process at hazardous waste sites and to cut clean-up costs wherever possible. This project was sponsored by the Strategic Environmental Research and Development Project (SERDP).

20813 (PNL–7722-Rev.2-Add.1) **[DOE method for evaluating environmental and waste management samples: Revision 1, Addendum 1].** Goheen, S.C. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 385p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014291. Source: OSTI; NTIS; INIS; GPO Dep.

The US Dapartment of Energy's (DOE's) environmental and waste management (EM) sampling and analysis activities require that large numbers of samples be analyzed for materials characterization, environmental surveillance, and site-remediation programs. The present document, DOE Methods for Evaluating Environmental

and Waste Management Samples (DOE Methods), is a supplemental resource for analyzing many of these samples.

20814 (PNL–10255) **Evaluation of HWVP feed preparation chemistry for an NCAW simulant – Fiscal year 1993: Effect of noble metals concentration on offgas generation and ammonia formation.** Patello, G.K.; Wiemers, K.D.; Bell, R.D.; Smith, H.D.; Williford, R.E.; Clemmer, R.G. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010687. Source: OSTI; NTIS; INIS; GPO Dep.

The High-Level Waste Vitrification Program is developing technology for the Department of Energy to immobilize high-level and transuranic wastes as glass for permanent disposal. Pacific Northwest Laboratory (PNL) is conducting laboratory-scale melter feed preparation studies using a HWVP simulated waste slurry, Neutralized Current Acid Waste (NCAW). A FY 1993 laboratory-scale study focused on the effects of noble metals (Pd, Rh, and Ru) on feed preparation offgas generation and NH_3 production. The noble metals catalyze H_2 and NH_3 production, which leads to safety concerns. The information gained from this study is intended to be used for technology development in pilot scale testing and design of the Hanford High-Level Waste Vitrification Facility. Six laboratory-scale feed preparation tests were performed as part of the FY 1993 testing activities using nonradioactive NCAW simulant. Tests were performed with 10%, 25%, 50% of nominal noble metals content. Also tested were 25% of the nominal Rh and a repeat of 25% nominal noble metals. The results of the test activities are described. 6 refs., 28 figs., 12 tabs.

20815 (PNL–10256) **Vapor space characterization of waste tank 241-BY-105: Results from samples collected on 7/7/94.** Pool, K.H.; Ligotke, M.W.; Clauss, T.W.; Lucke, R.B.; McVeety, B.D.; McCulloch, M.; Fruchter, J.S.; Goheen, S.C. Pacific Northwest Lab., Richland, WA (United States). May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012229. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes organic and inorganic results from vapors of the Hanford single-shell waste storage Tank 241-BY-105 (referred to as Tank BY-105). The results described here were obtained to support safety and toxicological evaluations. Quantitative results were obtained for the inorganic compounds ammonia (NH_3), nitrogen dioxide (NO_2), nitric oxide (NO), and water (H_2O). Sampling for hydrogen cyanide (HCN) and sulfur oxides (SO_x) was not requested. Several organic analytes were quantitatively determined, but quantities of non-TO-14 analytes were only estimated. Approximately 40 tentatively identified organic analytes were observed above the detection limit of (ca.) 10 ppb, but standards for most of these were not available at the time of analysis, and their quantitative determination is beyond the scope of this study. The SUMMA™ Canisters were also analyzed for components listed in U.S. Environmental Protection Agency (EPA) compendium Method TO-14. Of these only a few were observed above the 2-ppb detection limits. These are summarized in Table 3.1. Estimated quantitations also determined were of tentatively identified compounds (TICs). A summary of these results shows quantities of all TICs above the concentration of ca. 10 ppb. This consists of more than 40 organic analytes. The 6 organic analytes with the highest estimated concentrations are shown in Table 1. These 6 analytes account for approximately 45% of the total organic components in Tank BY-105. Detailed descriptions of the results appear in the text. Unlike tanks previously studied, normal paraffin hydrocarbons (NPHs) did not contribute significantly to the total organic concentration of the vapor headspace of Tank BY-105. The total concentration of TICs detected in the tank headspace samples was also much lower than that seen in other reported tanks averaging 6.5 Mg/m^3 for all three canisters collected.

20816 (PNL–10282) **Vapor space characterization of waste tank 241-BY-105 (in situ): Results from samples collected on May 9, 1994.** McVeety, B.D.; Pool, K.H.; Ligotke, M.W.; Clauss, T.W.; Lucke, R.B.; Sharma, A.K.; McCulloch, M.; Fruchter, J.S.; Goheen, S.C. Pacific Northwest Lab., Richland, WA (United States). May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012230. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes inorganic and organic analyses results from in situ samples obtained from the tank headspace of the Hanford waste storage Tank 241-BY-105 (referred to as Tank BY-105). The results described here were obtained to support safety and toxicological evaluations. A summary of the results for inorganic and organic analytes is listed. Detailed descriptions of the results appear in the text. Quantitative results were obtained for the inorganic compounds NH_3, NO_2, NO, HCN, and H_2O. Sampling for sulfur oxides was not requested. Results of the inorganic samples were affected by sampling errors that led to an undefined uncertainty in sample volume. Consequently, tank-headspace concentrations are estimated only. Thirty-nine tentatively identified organic analytes were observed above the detection limit of (ca.) 10 ppbv, but standards for most of these were not available at the time of analysis, and their quantitation is beyond the scope of this study. In addition, we looked for the 41 standard TO-14 analytes. Of these, only a few were observed above the 2-ppbv detection limit. The 16 organic analytes with the highest estimated concentrations are listed. These 16 analytes account for approximately 68% of the total or organic components in Tank BY-105.

20817 (PNL–10511) **Laboratory studies of gas generation and potential for tank wall corrosion during blending of high-level wastes at the West Valley Demonstration Project.** Gray, W.J.; Westerman, R.E. Pacific Northwest Lab., Richland, WA (United States). May 1995. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012764. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory experiments were conducted to simulate the transfer of acidic THOREX waste from Tank 8D-4 into the alkaline PUREX waste in Tank 8D-2 at West Valley. The purpose of the experiments was to explore means of minimizing the production of nitric oxide (NO) gas during mixing of the two wastes and to assess the potential for the gas to further react in the vapor space possibly leading to enhanced corrosion of the tank walls. Forty one THOREX/PUREX mixing tests were conducted to explore the effects of stirring rate, pH, THOREX addition rate, THOREX or PUREX dilution, and temperature. The two most important criteria for minimizing NO production were to maintain some degree of agitation and the keep the pH in the PUREX high, preferably >12. Steel corrosion tests were performed in the presence of low partial pressures of NO_2 and liquid water or water vapor. The NO_2 (from oxidation of NO in the vapor space) concentrations were representative of those derived from the THOREX/PUREX mixing tests. It was concluded that no significant corrosion of the tank walls would be expected under the anticipated THOREX/PUREX mixing conditions if the exposure was short (<100 days).

20818 (PNL-SA–24937) **Neural network based analysis for chemical sensor arrays.** Hashem, S.; Keller, P.E.; Kouzes, R.T.; Kangas, L.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States);Associated Western Universities, Inc., Salt Lake City, UT (United States). DOE Contract FG06-89ER75522. (CONF-9504137–2: SPIE: aero sense conference, San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95011490. Source: OSTI; NTIS; GPO Dep.

Compact, portable systems capable of quickly identifying contaminants in the field are of great importance when monitoring the environment. In this paper, we examine the effectiveness of using artificial neural networks for real-time data analysis of a sensor array. Analyzing the sensor data in parallel may allow for rapid identification of contaminants in the field without requiring highly selective individual sensors. We use a prototype sensor array which consists of nine tin-oxide Taguchi-type sensors, a temperature sensor, and a humidity sensor. We illustrate that by using neural network based analysis of the sensor data, the selectivity of the sensor array may be significantly improved, especially when some (or all) the sensors are not highly selective.

20819 (SAIC–94-002) **A review of the methods used by the US Environmental Protection Agency to assess the financial impacts of the repository regulations.** Pflum, C.G.; Mattson, S.R.; Matthusen, A.C. Science Applications International Corp., Las

Vegas, NV (United States). 16 Feb 1994. 24p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012991. Source: OSTI; NTIS; INIS; GPO Dep.

All Federal agencies must consider the financial impacts of their regulations. When costs significantly outweigh benefits, the Office of Management and Budget can recommend that Congress not provide the funds needed to implement the regulation. Without funds, the agency is forced to either revise or retract the regulation. This has happened previously with a regulation on uranium mill tailings proposed by the US Nuclear Regulatory Commission (NRC) and it could happen again with the US Environmental Protection Agency (EPA) regulations that govern the disposal of high-level radioactive waste (HLW). The EPA (1985, 1992) claims that its regulation: "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste" (40 CFR Part 191 or standards) does not increase costs above what the US Department of Energy (DOE) would spend anyway or, at most, what the DOE would spend to comply with 10 CFR Part 60: a regulation promulgated by the NRC. This report reviews and disputes the EPA claim. In Chapter 2 a summary of the basis for the EPA claim is presented and in Chapter 3 a critique of the basis of the claim is presented. This critique finds the EPA basis unrealistic, incomplete, and misleading. According to the EPA, a repository at Yucca Mountain would easily meet 40 CFR Part 191 even without the use of special engineered barriers. Because the NRC regulation (10 CFR Part 60) requires engineered barriers, the EPA places the onus for regulatory costs on the NRC. We disagree; the EPA standards drive regulatory costs as much as NRC regulations. The EPA has the higher responsibility for setting the overall standard for safety while the NRC can only implement this standard.

20820 (SAND–92-2121) **Laboratory measurements of gas flow along a pressurized grout/membrane/halite interface for the Waste Isolation Pilot Plant.** Ucpirti, H. (Univ. of Nevada, Reno, NV (United States)); Daemen, J.J.K.; Finley, R.E.; George, J.T. Sandia National Labs., Albuquerque, NM (United States). Jan 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010335. Source: OSTI; NTIS; INIS; GPO Dep.

A series of laboratory gas-flow tests has been performed on interfaces comprised of concrete, very low-density polyethylene membrane, and halite. These tests were conducted to (1) evaluate whether a meaningful test can be run to quantify the effectiveness of a membrane, and (2) aid in the design of an Alcove Gas Barrier at the Waste Isolation Pilot Plant (WIPP), where membranes of this type are being considered for use at the interface between the concrete or grout of the gas barrier structure and the surrounding halite. Over 400 longitudinal transient-flow and steady-state radial-flow tests have been completed. However, it is not clear from these tests that the test results can be meaningfully applied to the full-scale Alcove Gas Barrier configuration because the measured permeabilities are several orders of magnitude higher than the meter-scale in situ concrete seal tests conducted at the WIPP as part of the Small-Scale Seal Performance Tests. Results show that the membranes decrease gas permeability along the concrete/halite interface by one to two orders of magnitude to below 10^{-15} m^2 for the simplified test configurations. 28 refs., 11 figs., 16 tabs.

20821 (SAND–94-2011) **Studies of thermohydrologic flow processes using TOUGH2. Yucca Mountain Site Characterization Project.** Ho, C.K.; Eaton, R.R. Sandia National Labs., Livermore, CA (United States). Dec 1994. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010777. Source: OSTI; NTIS; INIS; GPO Dep.

Coupled thermal and hydrologic flow processes have been recognized as important factors in the evaluation of Yucca Mountain as a potential repository for high-level radioactive wastes. As a result, several models and numerical codes such as TOUGH2 have been used to investigate the thermohydrologic conditions near a potential nuclear waste repository. However, very few of these models have been tested through laboratory or field scale studies. This work has therefore focused on modeling well-controlled experiments of non-isothermal flow processes in porous media at different scales to serve two primary objectives: (1) identify processes that are potentially important to thermal and hydrologic transport at Yucca Mountain and (2) build confidence in models and codes through combined experimental and numerical studies of thermohydrologic behavior at different scales and conditions. In this report, three independent studies of thermohydrologic flow processes at laboratory and field scales are presented. The experiments and field studies that are presented here were performed independently of this work. The main focus of this report was to use the numerical code TOUGH2 to simulate the non-isothermal flow behavior observed in each experiment to generate understanding of the thermohydrologic processes and to gain confidence in the code. TOUGH2 was chosen due to its current use in calculations associated with Yucca Mountain and its capability of modeling the coupled transport of air, water, vapor, and heat in porous media.

20822 (SAND–94-2032) **Annotated bibliography National Environmental Policy Act (NEPA) documents for Sandia National Laboratories.** Harris, J.M. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011830. Source: OSTI; NTIS; INIS; GPO Dep.

The following annotated bibliography lists documents prepared by the Department of Energy (DOE), and predecessor agencies, to meet the requirements of the National Environmental Policy Act (NEPA) for activities and facilities at Sandia National Laboratories sites. For each NEPA document summary information and a brief discussion of content is provided. This information may be used to reduce the amount of time or cost associated with NEPA compliance for future Sandia National Laboratories projects. This summary may be used to identify model documents, documents to use as sources of information, or documents from which to tier additional NEPA documents.

20823 (SAND–94-2563/2) **Performance assessment of the direct disposal in unsaturated tuff or spent nuclear fuel and high-level waste owned by USDOE: Volume 2, Methodology and results.** Rechard, R.P. (ed.). Sandia National Labs., Albuquerque, NM (United States). Mar 1995. 679p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011840. Source: OSTI; NTIS; INIS; GPO Dep.

This assessment studied the performance of high-level radioactive waste and spent nuclear fuel in a hypothetical repository in unsaturated tuff. The results of this 10-month study are intended to help guide the Office of Environment Management of the US Department of Energy (DOE) on how to prepare its wastes for eventual permanent disposal. The waste forms comprised spent fuel and high-level waste currently stored at the Idaho National Engineering Laboratory (INEL) and the Hanford reservations. About 700 metric tons heavy metal (MTHM) of the waste under study is stored at INEL, including graphite spent nuclear fuel, highly enriched uranium spent fuel, low enriched uranium spent fuel, and calcined high-level waste. About 2100 MTHM of weapons production fuel, currently stored on the Hanford reservation, was also included. The behavior of the waste was analyzed by waste form and also as a group of waste forms in the hypothetical tuff repository. When the waste forms were studied together, the repository was assumed also to contain about 9200 MTHM high-level waste in borosilicate glass from three DOE sites. The addition of the borosilicate glass, which has already been proposed as a final waste form, brought the total to about 12,000 MTHM.

20824 (SAND–94-3267) **Performance benefits of telerobotics and teleoperation - enhancements for an arm-based tank waste retrieval system.** Horschel, D.S. (Sandia National Labs., Albuquerque, NM (United States)); Gibbons, P.W.; Draper, J.V. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013912. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates telerobotic and teleoperational arm-based retrieval systems that require advanced robotic controls. These systems will be deployed in waste retrieval activities in Hanford's

Single Shell Tanks (SSTs). The report assumes that arm-based, retrieval systems will combine a teleoperational arm and control system enhanced by a number of advanced and telerobotic controls. The report describes many possible enhancements, spanning the full range of the control spectrum with the potential for technical maturation. The enhancements considered present a variety of choices and factors including: the enhancements to be included in the actual control system, safety, detailed task analyses, human factors, cost-benefit ratios, and availability and maturity of technology. Because the actual system will be designed by an offsite vendor, the procurement specifications must have the flexibility to allow bidders to propose a broad range of ideas, yet build in enough restrictions to filter out infeasible and undesirable approaches. At the same time they must allow selection of a technically promising proposal. Based on a preliminary analysis of the waste retrieval task, and considering factors such as operator limitations and the current state of robotics technology, the authors recommend a set of enhancements that will (1) allow the system to complete its waste retrieval mission, and (2) enable future upgrades in response to changing mission needs and technological advances.

20825 (SAND–95-8005) **Pollution prevention opportunity assessment for the supercritical water oxidation flow reactor.** Phillips, N.M. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013916. Source: OSTI; NTIS; GPO Dep.

This pollution prevention opportunity assessment was conducted to evaluate the operation of the supercritical water oxidation flow reactor, which is located in Building 906, Room 107. This assessment documents the processes, identifies the hazardous chemical waste streams generated by these processes, recommends possible ways to minimize waste, and serves as a reference for future assessments of the supercritical water oxidation reactor process.

20826 (SKI-R–95-6) **Proceedings of the International seminar on design and manufacturing of copper canisters for nuclear waste.** Swedish Nuclear Power Inspectorate, Stockholm (Sweden); National Council for Nuclear Waste (KASAM), Stockholm (Sweden). Feb 1995. 136p. (CONF-9404264–: International seminar on design and manufacturing of copper canisters for nuclear waste, Sollentuna (Sweden), 27-28 Apr 1994). Order Number DE95630821. Source: OSTI; NTIS; INIS.

Separate abstracts have been prepared for 10 of the 15 papers presented at the meeting.

20827 (UCRL-ID–116187-95-2) **The Mixed Waste Management Facility, monthly report, February 1995.** Streit, R.D. Lawrence Livermore National Lab., CA (United States). Mar 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013424. Source: OSTI; NTIS; INIS; GPO Dep.

Technical progress continued in general accordance with the Mixed Waste Management Facility (MWMF) FY95 Plan. Engineering development and design continued in support of preliminary design of MWMF major subsystems. Peer reviews have begun in preparation for system preliminary design reviews. Procurements in support of engineering design/development have continued to increase. Significant effort to provide technical and cost trade-off information for the Project Baseline Revision 1.2 (PB1.2) and FY97 Validation was completed. Management focus during February centered upon addressing the rebaseline for MWMF for the FY97 Validation in March, and upon completing the permitting strategy. We completed a consistent baseline plan for Validation that satisfied the DOE constraints of integration with DWTF, schedule stretchout, overall Project cost, and FY cost profiles. The revised permitting strategy was completed and reviewed by a number of stakeholders (LLNL, DOE, State). The proposed strategy involves no RCRA RD&D permit, since all technology demonstrations can be done with surrogates and using limited treatability studies. The expenses for February continue to run somewhat below the plan due to the limited new hiring. This is a result of uncertain DOE funding and guidance to keep personnel to a minimum. However, the spending rate is picking up due to initiation of procurements for engineering development and a minimum of essential new hires. A significant imbalance in the OPEX/CENRTC funding split for FY95 exists (about $2.1M); DOE/OAK began to seek resolution this month. Critical-path items are DWTF construction, NEPA, and permitting (for both MWMF and DWTF). Contractual issues have delayed award of the A&E contract for DWTF, but work-arounds are in progress to avoid schedule impact. NEPA and permitting issues are discussed below. Progress on preliminary design for MWMF is close to schedule.

20828 (UCRL-ID–116187-95-3) **The Mixed Waste Management Facility monthly report, March 1995.** Streit, R.D. Lawrence Livermore National Lab., CA (United States). Apr 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012590. Source: OSTI; NTIS; GPO Dep.

This document presents details of the monthly activities of Lawrence Livermore National Laboratory in regards to the Mixed Waste Management Facility. Topics discussed include: quality assurance; regulations; program support; public participation; conceptual design; plant start-up; project management; feed preparation; molten salt, electrochemical, and wet oxidation; process transport and storage; and final waste forms.

20829 (UCRL-ID–116210-Pt.2) **The Mixed Waste Management Facility: Technology selection and implementation plan, Part 2, Support processes.** Streit, R.D.; Couture, S.A. Lawrence Livermore National Lab., CA (United States). Mar 1995. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95010919. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to establish the foundation for the selection and implementation of technologies to be demonstrated in the Mixed Waste Management Facility, and to select the technologies for initial pilot-scale demonstration. Criteria are defined for judging demonstration technologies, and the framework for future technology selection is established. On the basis of these criteria, an initial suite of technologies was chosen, and the demonstration implementation scheme was developed. Part 1, previously released, addresses the selection of the primary processes. Part II addresses process support systems that are considered "demonstration technologies." Other support technologies, e.g., facility off-gas, receiving and shipping, and water treatment, while part of the integrated demonstration, use best available commercial equipment and are not selected against the demonstration technology criteria.

20830 (UCRL-ID–118660) **Ceramic package fabrication for YMP nuclear waste disposal.** Wilfinger, K. Lawrence Livermore National Lab., CA (United States). Aug 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011522. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this work is to develop alternate materials/design concepts to metal barriers for the Nevada Nuclear Waste Storage Investigations Project. There is some potential that site conditions may prove to be too aggressive for successful employment of the metal alloys under current consideration or that performance assessment models will predict metal container degradation rates that are inconsistent with the goal of substantially complete containment included in the NRC regulations. In the event that the anticipated lifetimes of metal containers are considered inadequate, alternate materials (i.e. ceramics or ceramic/metal composites) will be chosen due to superior corrosion resistance. This document was prepared using information taken from the open literature, conversations and correspondence with vendors, news releases and data presented at conferences to determine what form such a package might take. This discussion presents some ceramic material selection criteria, alternatives for the materials which might be used and alternatives for potential fabrication routes. This includes "stand alone" ceramic components and ceramic coatings/linings for metallic structures. A list of companies providing verbal or written information concerning the production of ceramic or ceramic lined waste containers appears at the end of this discussion.

20831 (UCRL-ID–118699) **Progress report on pre-test calculations for the large block test.** Lee, K.H. Lawrence Livermore

National Lab., CA (United States). 20 Jan 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011433. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy's (DOE) Yucca Mountain Site Characterization Project (YMP) is investigating the suitability of the Topopah Spring tuff in the thick vadose zone at Yucca Mountain, Nevada, as a host rock for permanent disposal of high-level radioactive waste. As part of the YMP, a group of field tests, referred to as the Large Block Test (LBT), will be conducted on a large electrically heated block of Topopah Spring tuff, isolated at Fran Ridge, Nevada Test Site. The block, which will be 3 x 3 m in horizontal dimensions and 4.5 m in height, will be heated by electrical heaters. The goals of the LBT axe to gain information on the coupled thermal-mechanical-hydrological-chemical processes active in the near-field environment of a repository; to provide field data for testing and calibrating models; and to help the development of measurement systems and techniques. This progress report presents results of on-going numerical modeling calculations carried out in support of the LBT design. An equivalent continuum model with an upper boundary temperature of 60°C was used to simulate the hydrothermal response of the block to heating over a one-year period. The total heating power was started at 1500 W and later reduced to maintain an approximately uniform temperature of 138-140°C. For a homogeneous bulk permeability case, the results show the formation of a distinct dry-out zone in and around the heater plane, and well-developed condensation zones above and below the heater plane. For a heterogeneous permeability distribution, the condensation zone above the heater plane was not well developed. This difference in results suggests that water saturation changes might be sensitive to changes in bulk permeability distribution. Rock temperatures were almost unaffected by permeability distribution. Heat flow was dominated by conduction. No liquid flow through the top of the block was predicted.

20832 (UCRL-ID–119033) **Hydrological property measurements of Topopah Spring Tuff.** Roberts, J.J.; Lin, W. Lawrence Livermore National Lab., CA (United States). Apr 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011434. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the progress made during FY 1994 on hydrological property measurements of samples from Topopah Spring tuff at Yucca Mountain, Nevada. These measurements were performed in the laboratory at Lawrence Livermore National Laboratory. This report contains descriptions of experimental designs and procedures, data, observations, and preliminary analyses, and also describes planned future work. The report is organized into three sections: (1) permeability of fractured Topopah Spring tuff as a function of temperature and confining pressure; (2) electrical properties of Topopah Spring tuff as a function of temperature and of saturation; and (3) moisture retention measurements of Topopah Spring tuff as a function of temperature.

20833 (UCRL-ID–119298) **Characterization of mixed waste for sorting and inspection using non-intrusive methods.** Roberson, G.P.; Ryon, R.W.; Bull, N.L. Lawrence Livermore National Lab., CA (United States). Dec 1994. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012106. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of mixed wastes (that is, radioactive and otherwise hazardous) requires that all hazardous, non-conforming, and radioactive materials be identified, localized, and quantified. With such information, decisions can be made regarding whether the item is treatable or has been adequately treated. Much of the required information can be gained without taking representative samples and analyzing them in a chemistry laboratory. Non-intrusive methods can be used to provide this information on-line at the waste treatment facility. Ideally, the characterization would be done robotically, and either automatically or semi-automatically in order to improve efficiency and safety. For the FY94 Mixed Waste Operations (MWO) project, a treatable waste item is defined as a homogeneous metal object that has external radioactive or heavy metal hazardous contamination. Surface treatment of some kind would therefore be the treatment method to be investigated. The authors developed sorting and inspection requirements, and assessed viable non-intrusive techniques to meet these requirements. They selected radiography, computed tomography and X-ray fluorescence. They have characterized selected mock waste items, and determined minimum detectable amounts of materials. They have demonstrated the efficiency possible by integrating radiographic with tomographic data. Here, they developed a technique to only use radiographic data where the material is homogeneous (fast), and then switching to tomography in those areas where heterogeneity is detected (slower). They also developed a tomographic technique to quantify the volume of each component of a mixed material. This is useful for such things as determining ash content. Lastly, they have developed a document in MOSAIC, an Internet multi-media browser. This document is used to demonstrate the ability to share data and information world-wide.

20834 (UCRL-ID–120133) **Plutonium distribution: Summary of public and governmental support issues.** Pasternak, A. Lawrence Livermore National Lab., CA (United States). 31 Mar 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013295. Source: OSTI; NTIS; GPO Dep.

Obtaining strong public and governmental support for the plutonium disposition program and for the projects comprising the selected disposition options will be essential to the success of the program in meeting non-proliferation goals established as national policy. This paper summarizes issues related to public and governmental support for plutonium disposition. Recommendations are offered which rest on two fundamental assumptions: (1) public and political support derive from public trust and confidence, and (2) despite widespread support for U.S. non-proliferation goals, establishing and operating facilities to carry out the program will entail controversy. Documentation for the Administration's policy on non-proliferation as it relates to plutonium disposition is cited and summarized as background for ongoing planning efforts by the Department of Energy (DOE). Consensus is a reasonable goal for efforts to secure public and governmental support for the plutonium disposition program and its elements; unanimity is very unlikely. The program will be aided by the popular recognition of the importance of the nation's non-proliferation goals, the potential for an energy dividend if an energy production option is selected ("Swords to Plowshares" metaphor), the possibility of influencing disposition decisions in other countries, and the clear need to do something with the excess material ("the no action alternative" will not suffice).

20835 (UCRL-JC–116418) **A heated large block test for high level nuclear waste management.** Lin, W.; Wilder, D.G.; Blink, J.A.; Blair, S.C.; Buscheck, T.A.; Glassley, W.E.; Lee, K.; Owens, M.W.; Roberts, J.J. Lawrence Livermore National Lab., CA (United States). Jan 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950435–2: 2. international conference on mechanics of jointed and faulted rock, Vienna (Austria), 10-14 Apr 1995). Order Number DE95011437. Source: OSTI; NTIS; INIS; GPO Dep.

The radioactive decay heat from high-level nuclear waste may, depending on the thermal load, create coupled thermal-mechanical-hydrological-chemical (TMHC) processes in the host rock of a repository. A heated large block test (LBT) is designed to understand some of the TNMC processes. A block of Topopah Spring tuff of about 3 x 3 x 4.5 m was isolated at Fran Ridge, Nevada Test Site. Small blocks of the rock adjacent to the large block were collected for laboratory testing of some individual thermal-mechanical, thermal-hydrological, and thermal-chemical processes. The large block will be heated by heaters within so that a dryout zone and a condensate zone will exist simultaneously. Guard heaters on the block sides will be used to minimize horizontal heat losses. A constant load of about 4 MPa will be applied to the top and sides of the large block. The sides will be sealed with moisture and thermal barriers. Temperature, moisture content, pore pressure, chemical composition, stress, displacement, electrical resistivity, acoustic emissions, and acoustic velocities will be measured throughout the block during the heating and cool-down phases. The results from the experiments on small blocks and the tests on the large block will provide a better understanding of some

concepts of the coupled TMHC processes. The progress of the project is presented in this paper.

20836 (UCRL-JC–118898) **Remotely controlled reagent feed system for mixed waste treatment Tank Farm.** Dennison, D.K.; Bowers, J.S.; Reed, R.K. Lawrence Livermore National Lab., CA (United States). Feb 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950877–8: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95011965. Source: OSTI; NTIS; INIS; GPO Dep.

LLNL has developed and installed a large-scale. remotely controlled, reagent feed system for use at its existing aqueous low-level radioactive and mixed waste treatment facility (Tank Farm). LLNL's Tank Farm is used to treat aqueous low-level and mixed wastes prior to vacuum filtration and to remove the hazardous and radioactive components before it is discharged to the City of Livermore Water Reclamation Plant (LWRP) via the sanitary sewer in accordance with established limits. This reagent feed system was installed to improve operational safety and process efficiency by eliminating the need for manual handling of various reagents used in the aqueous waste treatment processes. This was done by installing a delivery system that is controlled either remotely or locally via a programmable logic controller (PLC). The system consists of a pumping station, four sets of piping to each of six 6,800-L (1,800-gal) treatment tanks, air-actuated discharge valves at each tank, a pH/temperature probe at each tank, and the PLC-based control and monitoring system. During operation, the reagents are slowly added to the tanks in a preprogrammed and controlled manner while the pH, temperature, and liquid level are continuously monitored by the PLC. This paper presents the purpose of this reagent feed system, provides background related to LLNL's low-level/mixed waste treatment processes, describes the major system components, outlines system operation, and discusses current status and plans.

20837 (UCRL-JC–118906) **Stereo vision based automated grasp planning.** Wilhelmsen, K. (Lawrence Livermore National Lab., CA (United States)); Huber, L.; Silva, D.; Grasz, E.; Cadapan, L. Lawrence Livermore National Lab., CA (United States). Feb 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950232–33: 6. American Nuclear Society meeting on robotics and remote systems, Monterey, CA (United States), 5-10 Feb 1995). Order Number DE95009618. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy has a need for treating existing nuclear waste. Hazardous waste stored in old warehouses needs to be sorted and treated to meet environmental regulations. Lawrence Livermore National Laboratory is currently experimenting with automated manipulations of unknown objects for sorting, treating, and detailed inspection. To accomplish these tasks, three existing technologies were expanded to meet the increasing requirements. First, a binocular vision range sensor was combined with a surface modeling system to make virtual images of unknown objects. Then, using the surface model information, stable grasp of the unknown shaped objects were planned algorithmically utilizing a limited set of robotic grippers. This paper is an expansion of previous work and will discuss the grasp planning algorithm.

20838 (UCRL-JC–119106) **The large block test, a progress report.** Lin, W. (and others); Wilder, D.; Blink, J.; Berge, P.; Blair, S.; Brugman, V.; Carlson, R.; Lee, K.; Owens, M.; Pletcher, R. Lawrence Livermore National Lab., CA (United States). Oct 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950570–20: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95011435. Source: OSTI; NTIS; INIS; GPO Dep.

The Yucca Mountain Site Characterization Project investigates Yucca Mountain, Nevada, for its suitability as a potential repository for high-level nuclear wastes. The major functional requirement of a nuclear waste repository is that radioactive nuclides should not significantly contaminate the accessible environment for the life span of a repository. When emplaced in a repository, the radioactive decay heat of the high-level nuclear waste may cause coupled thermal-mechanical-hydrological-chemical (TMHC) processes in the near-field. The coupled TMHC processes must be understood before model calculations can be performed to confidently predict the near-field environments. The Large Block Test (LBT) is designed to provide experiments with controlled boundary conditions so that they will be more useful for testing some of the concepts of the coupled TMHC processes. Specifically, the LBT will study the dominant heat transfer mechanism, condensate refluxing, rewetting of the dry-out zone following the cool-down of the block, deformation, and chemical variations in the water. The LBT will also evaluate test methodologies and instruments that may be employed in future tests at the Exploratory Studies Facility and evaluate the corrosion/oxidation potential of coupons of candidate waste package materials in a heated rock environment. This paper presents a progress report of the LBT.

20839 (UCRL-JC–119121) **Measuring geomechanical properties of Topopah Spring Tuff at the 1-meter scale.** Blair, S.C.; Berge, P.A. Lawrence Livermore National Lab., CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950570–18: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95011441. Source: OSTI; NTIS; INIS; GPO Dep.

The Yucca Mountain Site Characterization Project is studying physical and chemical properties of Topopah Spring tuff and coupled thermal, mechanical, hydrological, and geochemical processes expected in the near-field environment of the potential waste repository at Yucca Mountain, Nevada. Investigating the suitability of Topopah Spring tuff as a host rock for radioactive waste disposal includes measuring mechanical properties. Since heterogeneities vary with scale, from vugs and cracks at the hand-sample scale to fractures and vertical variations in degree of welding at the outcrop scale, mechanical properties of the tuff depend on scale. The Lawrence Livermore National Laboratory has planned a Large Block Test (LBT) to investigate rock mass properties and coupled processes at elevated temperatures in Topopah Spring tuff at the scale of a few meters. This paper describes planned laboratory experiments in support of the LBT, to measure elastic properties and mechanical behavior of Topopah Spring tuff at the scale of a few cm to 1 m. The laboratory experiments will include measurement of stress-strain behavior, acoustic emissions during heating, and elastic wave velocities in small blocks of tuff.

20840 (UCRL-JC–119724) **The role of cation exchange in controlling groundwater chemistry at Aspo, Sweden.** Viani, B.E.; Bruton, C.J. Lawrence Livermore National Lab., CA (United States). Jan 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950570–19: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95011440. Source: OSTI; NTIS; INIS; GPO Dep.

Construction-induced groundwater flow has resulted in the mixing of relatively dilute shallow groundwater with more concentrated groundwater at depth in the underground Hard Rock Laboratory (HRL) at Aespoe, Sweden. The observed compositional variation of the mixed groundwater cannot be explained using a conservative mixing model. The geochemical modeling package EQ3/6, to which a cation-exchange model was added, was used to simulate mixing between the two fluids. The results of modeling simulations suggest that cation exchange between groundwater and fracture-lining clays can explain the major element fluid chemistry observed in the HRL. The quantity of exchanger required to match simulated with observed fluid chemistry is reasonable and is consistent with the observed fracture mineralogy. This preliminary study establishes cation exchange as a viable mechanism for controlling the chemical evolution of groundwaters in a fracture-dominated dynamic flow system. This modeling study also strengthens their confidence in the ability to model the potential effects of fracture-lining minerals on the transport of radionuclides in a high level nuclear waste repository.

20841 (UCRL-JC–119874) **Analysis and section of processes for the disposition of excess fissile material from nuclear weapon dismantlement in the United States.** Myers,

B.R. (Lawrence Livermore National Lab., CA (United States)); Armantrout, G.A.; Erickson, R. Lawrence Livermore National Lab., CA (United States). Feb 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9503148–1: Radioactive waste management and space meeting on peaceful disposition on weapon grade materials, Berlin (Germany), 3-9 Mar 1995). Order Number DE95011720. Source: OSTI; NTIS; GPO Dep.

The end of the cold war and the acceleration of nuclear disarmament efforts by the United States (US) and Russia are generating large quantities of surplus fissile nuclear materials that are no longer needed for military purposes. The safe and secure disposition of this surplus material to prevent theft or reuse in weapons has become a high priority for the US Department of Energy (USDOE). Many options exist for storage and disposition (use or disposal) of these surplus materials. The criteria, which have been developed from the basis for a preliminary "screening" of options, to eliminate from further consideration those options that do not meet minimal requirements. Factors, or attributes, contained in the screening and selection criteria include: (1) resistance to theft and diversion by unauthorized parties, (2) resistance to retrieval, extraction, and reuse by the host nation, (3) technical viability, (4) environmental, safety, and health impacts, (5) cost effectiveness, (6) timeliness, (7) fostering of progress and cooperation with Russia and others, (8) public and institutional acceptance, and (9) additional benefits. The evaluation of environmental impacts, in accordance with the US National Environmental Policy Ac (NEPA) process, is an integral part of the overall evaluation process. Because of the variety of physical and chemical forms of the nuclear material inventory, and because of the large number of possible disposition technologies and final forms, several hundred possible pathways to disposition have been defined and have undergone a systematic selection process. Also, because nuclear material disposition will have far ranging impacts, extensive public, in the form of public and stakeholder, input was integral to the selection process.

20842 (UCRL-JC–120053) **Disposition of excess fissile materials in deep boreholes.** Halsey, W.G. (Lawrence Livermore National Lab., CA (United States)); Danker, W.; Morley, R. Lawrence Livermore National Lab., CA (United States). Sep 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9509161–1: International surplus fissile materials conference, Berlin (Germany), 3-9 Sep 1995). Order Number DE95011692. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of recent changes throughout the world, a substantial inventory of excess separated plutonium is expected to result from dismantlement of US nuclear weapons. The safe and secure management and eventual disposition of this plutonium, and of a similar inventory in Russia, is a high priority. A variety of options (both interim and permanent) are under consideration to manage this material. The permanent solutions can be categorized into two broad groups: direct disposal and utilization. Plutonium utilization options have in common the generation of high-level radioactive waste which will be disposed of in a mined geologic disposal system to be developed for spent reactor fuel and defense high level waste. Other final disposition forms, such as plutonium metal, plutonium oxide and plutonium immobilized without high-level radiation sources may be better suited to placement in a custom facility. This paper discusses a leading candidate for such a facility; deep (several kilometer) borehole disposition. The deep borehole disposition concept involves placing excess plutonium deep into old stable rock formations with little free water present. The safety argument centers around ancient groundwater indicating lack of migration, and thus no expected communication with the accessible environment until the plutonium has decayed.

20843 (USGS-OFR–94-342) **Summary of lithologic logging of new and existing boreholes at Yucca Mountain, Nevada, August 1993 to February 1994.** Geslin, J.K.; Moyer, T.C.; Buesch, D.C. Geological Survey, Denver, CO (United States). 1995. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. Order Number DE95011866. Source: OSTI; NTIS; INIS; GPO Dep.

Yucca Mountain, Nevada, is being investigated as a potential site for a high-level radioactive waste repository. This report summarizes the lithologic logging of new and existing boreholes at Yucca Mountain that was done from August 1993 to February 1994 by the Rock Characteristics Section, Yucca Mountain Project Branch, US Geological Survey (USGS). Units encountered during logging include Quaternary-Tertiary alluvium/colluvium, Tertiary Rainier Mesa Tuff, all units in the Tertiary Paintbrush Group, Tertiary Calico Hills Formation and Tertiary Prow Pass Tuff. We present criteria used for recognition of stratigraphic contacts, logging results as tables of contact depths for core from neutron (UZN) boreholes and graphical lithologic logs for core from non-UZN boreholes, and descriptions of several distinctive nonwelded tuffs recognized in the PTn hydrogeologic unit of the Paintbrush Group.

20844 (USGS-OFR–94-456) **Meteorological, stream-discharge, and water-quality data for water year 1992 from two basins in Central Nevada.** McKinley, P.W. (Geological Survey, Denver, CO (United States)); Oliver, T.A. USDOE Nevada Operations Office, Las Vegas, NV (United States); Geological Survey, Denver, CO (United States). 1995. 56p. Sponsored by Geological Survey, Reston, VA (United States);USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. Order Number DE95011552. Source: OSTI; NTIS; INIS; GPO Dep.

The US Geological Survey, in cooperation with the US Department of Energy, is studying Yucca Mountain, Nevada, as a potential repository for high level nuclear waste. As part of the Yucca Mountain Site Project, the analog recharge study is providing data for the evaluation of recharge to the Yucca Mountain ground-water system given a cooler and wetter climate than currently exists. The current and climatic conditions are favorable to the isolation of radioactive waste. Because waste isolation from the accessible environment for 10,000 years is necessary, climatic change and the potential for increased ground-water recharge need to be considered as part of the characterization of the potential repository. Therefore, two small basins, measuring less than 2 square miles, were studied to determine the volume of precipitation available for recharge to ground water. The semiarid 3-Springs Basin is located to the east of Kawich Peak in the Kawich Range east of Tonopah, Nevada. Stewart Basin is a subalpine drainage basin north of Arc Dome in the Toiyabe Range north of Tonopah, Nevada. The purpose of this publication is to make available the meteorological, stream-discharge, and water-quality data collected during the study. Meteorological data collected include air temperature, soil temperature, solar radiation, and relative humidity. Stream-discharge data were collected from the surface-water outlet of each basin. Water-quality data are chemical analyses of water samples collected from surface- and ground-water sources. Each basin has a meteorological station located in the lower and upper reaches of the basin. Hydrologic records include stream-discharge and water-quality data from the lower meteorological site and water-quality data from springs within the basins.

20845 (WHC-EP–0474-16) **Quarterly report on the Ferrocyanide Safety Program for the period ending, March 31, 1995.** Cash, R.J.; Meacham, J.E.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012969. Source: OSTI; NTIS; INIS; GPO Dep.

This quarterly report provides a status of the activities underway on the Ferrocyanide Safety Issue at the Hanford Site, including actions in response to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 90-7 (FR 1990). In March 1991, a DNFSB implementation plan (Cash 1991) responding to the six parts of Recommendation 90-7 was prepared and sent to the DNFSB. A Ferrocyanide Safety Program Plan addressing the total Ferrocyanide Safety Program, including the six parts of DNFSB Recommendation 90-7, was released in October 1994 (DOE 1994b). Activities in the program plan are underway or have been completed, and the status of each is described in Sections 2.0 and 3.0 of this report.

20846 (WHC-EP–0827-Rev.1) **Overview of the performance objectives and scenarios of TWRS Low-Level Waste Disposal Program. Revision 1.** Westinghouse Hanford Co., Richland, WA

(United States). Jan 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010576. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of past Department of Energy (DOE) weapons material production operations, Hanford now stores nuclear waste from processing facilities in underground tanks on the 200 area plateau. An agreement between the DOE, the Environmental Protection Agency (EPA), and the Washington state Department of Ecology (the Tri-Party Agreement, or TPA) establishes an enforceable schedule and a technical framework for recovering, processing, solidifying, and disposing of the Hanford tank wastes. The present plan includes retrieving the tank waste, pre-treating the waste to separate into low level and high level streams, and converting both streams to a glass waste form. The low level glass will represent by far the largest volume and lowest quantity of radioactivity (i.e., large volume of waste chemicals) of waste requiring disposal. The low level glass waste will be retrievably stored in sub-surface disposal vaults for several decades. Assuming the low level disposal system proves to be acceptable, the disposal site will be closed with the low level waste in place. If the disposal system is not acceptable, then the waste will be subject to possible retrieval followed by some other disposal solution. Westinghouse Hanford Company is also planning to emplace the waste so that it is retrievable for up to 50 years after completion of the tank waste processing.

20847 (WHC-EP–0828) **Scenarios of the TWRS low-level waste disposal program.** Westinghouse Hanford Co., Richland, WA (United States). Oct 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012840. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of past Department of Energy (DOE) weapons material production operations, Hanford now stores nuclear waste from processing facilities in underground tanks on the 200 Area plateau. An agreement between the DOE, the Environmental Protection Agency (EPA), and the Washington state Department of Ecology (the Tri-Party Agreement, or TPA) establishes an enforceable schedule and a technical framework for recovering, processing, solidifying, and disposing of the Hanford tank wastes. The present plan includes retrieving the tank waste, pretreating the waste to separate into low level and high level streams, and converting both streams to a glass waste form. The low level glass will represent by far the largest volume and lowest quantity of radioactivity (i.e., large volume of waste chemicals) of waste requiring disposal. The low level glass waste will be retrievably stored in sub-surface disposal vaults for several decades. If the low level disposal system proves to be acceptable, the disposal site will be closed with the low level waste in place. If, however, at some time the disposal system is found to be unacceptable, then the waste can be retrieved and dealt with in some other manner. WHC is planning to emplace the waste so that it is retrievable for up to 50 years after completion o the tank waste processing. Acceptability of disposal of the TWRS low level waste at Hanford depends on technical, cultural, and political considerations. The Performance Assessment is a major part of determining whether the proposed disposal action is technically defensible. A Performance Assessment estimates the possible future impact to humans and the environment for thousands of years into the future. In accordance with the TPA technical strategy, WHC plans to design a near-surface facility suitable for disposal of the glass waste.

20848 (WHC-EP–0828-Rev.1) **Scenarios of the TWRS low-level waste disposal program. Revision 1.** Westinghouse Hanford Co., Richland, WA (United States). Jan 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012791. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of past Department of Energy (DOE) weapons material production operations, Hanford now stores nuclear waste from processing facilities in underground tanks on the 200 area plateau. An agreement between the DOE, the Environmental Protection Agency (EPA), and the Washington state Department of Ecology (the Tri-Party Agreement, or TPA) establishes an enforceable schedule and a technical framework for recovering, processing, solidifying, and disposing of the Hanford tank wastes. The present plan includes retrieving the tank waste, pre-treating the waste to separate into low level and high level streams, and converting both streams to a glass waste form. The low level glass will represent by far the largest volume and lowest quantity of radioactivity (i.e., large volume of waste chemicals) of waste requiring disposal. The low level glass waste will be retrievably stored in sub-surface disposal vaults for several decades. If the low level disposal system proves to be acceptable, the disposal site will be closed with the low level waste in place. If, however, at some time the disposal system is found to be unacceptable, then the waste can be retrieved and dealt with in some other manner. WHC is planning to emplace the waste so that it is retrievable for up to 50 years after completion of the tank waste processing. Acceptability of disposal of the TWRS low level waste at Hanford depends on technical, cultural, and political considerations. The Performance Assessment is a major part of determining whether the proposed disposal action is technically defensible. A Performance Assessment estimates the possible future impact to humans and the environment for thousands of years into the future. In accordance with the TPA technical strategy, WHC plans to design a near-surface facility suitable for disposal of the glass waste.

20849 (WHC-EP–0856) **Tank waste remediation system operational scenario.** Johnson, M.E. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013573. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Waste Remediation System (TWRS) mission is to store, treat, and immobilize highly radioactive Hanford waste (current and future tank waste and the strontium and cesium capsules) in an environmentally sound, safe, and cost-effective manner (DOE 1993). This operational scenario is a description of the facilities that are necessary to remediate the Hanford Site tank wastes. The TWRS Program is developing technologies, conducting engineering analyses, and preparing for design and construction of facilities necessary to remediate the Hanford Site tank wastes. An Environmental Impact Statement (EIS) is being prepared to evaluate proposed actions of the TWRS. This operational scenario is only one of many plausible scenarios that would result from the completion of TWRS technology development, engineering analyses, design and construction activities and the TWRS EIS. This operational scenario will be updated as the development of the TWRS proceeds and will be used as a benchmark by which to evaluate alternative scenarios.

20850 (WHC-EP–0863) **Centralized consolidation/recycling center.** St. Georges, L.T. (Westinghouse Hanford Co., Richland, WA (United States)); Poor, A.D. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013580. Source: OSTI; NTIS; INIS; GPO Dep.

There are approximately 175 separate locations on the Hanford Site where dangerous waste is accumulated in hundreds of containers according to compatibility. Materials that are designated as waste could be kept from entering the waste stream by establishing collection points for these materials and wastes and then transporting them to a centralized consolidation/recycling center (hereinafter referred to as the consolidation center). Once there the materials would be prepared for offsite recycling. This document discusses the removal of batteries, partially full aerosol cans, and DOP light ballasts from the traditional waste management approach, which eliminates 89 satellite accumulation areas from the Hanford Site (43 for batteries, 33 for aerosols, and 13 for DOP ballasts). Eliminating these 89 satellite accumulation areas would reduce by hundreds the total number of containers shipped offsite as hazardous waste (due to the increase in containers when the wastes that are accumulated are segregated according to compatibility for final shipment). This new approach is in line with the U.S. Environmental Protection Agency's (EPA) draft Universal Waste Rules for these "nuisance" and common waste streams. Additionally, future reviews of other types of wastes that can be handled in this less restrictive and more cost-effective manner will occur as part of daily operations at the consolidation center. The Hanford Site has been identified as a laboratory for reinventing government by the Secretary of the U.S. Department of Energy (DOE), Hazel

O'Leary, and as a demonstration zone where "innovative ideas, processes and technologies can be created, tested and demonstrated." Additionally, DOE, EPA, and the Washington State Department of Ecology (Ecology) have agreed to cut Hanford cleanup costs by $1 billion over a 5-year period.

20851 (WHC-SA–2616) **A parametric study of double-shell tank response to internal high-frequency pressure loading.** Baliga, R. (ADVENT Engineering Services, Inc., San Ramon, CA (United States)); Choi, K.; Shulman, J.S.; Strehlow, J.P.; Abatt, G. Westinghouse Hanford Co., Richland, WA (United States). Feb 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950740–40: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95008787. Source: OSTI; NTIS; INIS; GPO Dep.

The double-shell waste tank 241SY101 (SY101) is a 3,785,400-liter tank used to store radioactive waste at the Hanford Site near Richland, Washington. The tank waste has formed two layers of sludge in the tank; a convective and a nonconvective layer. Ongoing reactions in the waste cause a buildup of hydrogen molecules that become trapped within the nonconvective layer of the waste. Various means of preventing the buildup of hydrogen molecules in the nonconvective layer have been investigated, including the use of a sonic probe that would transmit high-frequency acoustic pressure waves into the nonconvective layer of the waste. During the operation of the sonic probe, the pressure waves transmitted from the probe induce pressure time history loading on the inside surface of the primary tank. For low-frequency fluid-structure interaction loads, such as those associated with seismic events, the convective and impulsive effects of the waste-filled tank are well documented. However, for high-frequency loading, such as that associated with acoustic pressure waves, interactions between the waste and the primary tank are not understood. The pressure time history is represented by a harmonic function with a frequency range between 30 and 100 Hz. Structural analyses of the double-shell tank have been performed that address the tank's response to the sonic probe acoustic pressure loads. This paper addresses the variations in the tank response as a function of percent waste mass considered to be effective in the dynamic excitation of the tank. It also compares results predicted by analyses that discretely model the liquid waste and presents recommendations for the simplified effective mass approach. Also considered in the parametric study is the effect of damping on the tank response for the same pressure loading.

20852 (WHC-SA–2643) **Issues in performance assessments for disposal of US Department of Energy low-level waste.** Wood, D.E. (Westinghouse Hanford Co., Richland, WA (United States)); Wilhite, E.L.; Duggan, G.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950917–7: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95007781. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) and its contractors have long been pioneers in the field of radiological performance assessment (PA). Much effort has been expended in developing technology and acquiring data to facilitate the assessment process. This is reflected in DOE Order 5820.2A, Radioactive Waste Management Chapter III of the Order lists policy and requirements to manage the DOEs low-level waste; performance objectives for low-level waste management are stated to ensure the protection of public health and the environment. A radiological PA is also required to demonstrate compliance with the performance objectives. DOE Order 5820.2A further requires that an Oversight and Peer Review Panel be established to ensure consistency and technical quality around the DOE complex in the development and application of PA models that include site-specific geohydrology and waste composition. The DOE has also established a Performance Assessment Task Team (PATT) to integrate the activities of sites that are preparing PAs. The PATT's purpose is to recommend policy and guidance to DOE on issues that impact PAs so that the approaches taken are as consistent as possible across the DOE complex.

20853 (WHC-SA–2761) **Educational understanding of pollution prevention in decontamination and decommissioning/environmental restoration activities.** Betsch, M.D. (Westinghouse Hanford Co., Richland, WA (United States)); Lewis, R.A. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9505111–3: 11. pollution prevention conference: shaping the future through pollution prevention involvement - commitment - progress, Knoxville, TN (United States), 16-18 May 1995). Order Number DE95012573. Source: OSTI; NTIS; INIS; GPO Dep.

Demolishing outdated structures from the US Department of Energy Hanford Site in Washington, generates large quantities of waste which can be minimized. The Hanford cleanup is one of the world's largest and most complex environmental restoration efforts. Approximately 280 square miles of ground water and soil are contaminated; there are more than 80 surplus facilities, including nine shut-down nuclear reactors in various stages of decay; and there are 177 underground waste storage tanks containing highly radioactive waste. In all, 1,500 cleanup sites have been identified and the Environmental Restoration Contractor (ERC) is currently responsible for surveillance and maintenance of 170 structures. A two hour orientation training in pollution prevention was developed by the Westinghouse Hanford Company to provide all Decontamination and Decommissioning/Environmental Restoration (D&D/ER) personnel with the knowledge to apply waste minimization principles during their cleanup activities. The ERC Team Pollution Prevention Workshop serves to communicate pollution prevention philosophies and influences the way D&D/ER projects are conducted at the Hanford Site.

20854 (WHC-SA–2768) **Laboratory waste minimization during the operation startup phase.** Morrison, J.A. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9505111–2: 11. pollution prevention conference: shaping the future through pollution prevention involvement - commitment - progress, Knoxville, TN (United States), 16-18 May 1995). Order Number DE95013574. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Sampling and Characterization Facility (WSCF) Laboratory was opened for occupancy in October, 1994. It is the first of its kind on the Hanford Site, a low level lab located in an area of high level radiological material. The mission of the facility is to analyze process samples from two on-line effluent treatment plants. One of these plants is operating and the other is due to begin operations by the end of 1995. The VSCF also performs air sampling analysis for routine radiological surveillance filter papers drawn from around the Hanford Site. Because this type of laboratory had not been in operation before, there was only speculation about the types and amounts of waste that would be generated. The laboratory personnel assigned to WSCF were assembled from existing labs on the Hanford Site and from outside the Hanford Site community. For some, it was a first time experience working on a site where a twenty mile drive is sometimes required to visit another building. For others, it was a change in the way business is conducted using state-of-the-art equipment, a new building, and a chance to approach issues as a team from the beginning. It is how this team came together and the issues that were discussed, sometimes uncomfortably, that lead to the current success. The outcome of this process is discussed in this paper.

20855 (WHC-SA–2777) **Introduction to Radcalc: A computer program to calculate the radiolytic production of hydrogen gas from radioactive wastes in packages.** Green, J.R. (and others); Hillesland, K.E.; Field, J.G. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9506150–5: 2. annual Department of Energy defense programs packaging workshop, San Francisco, CA (United States), 12-15 Jun 1995). Order Number DE95012839. Source: OSTI; NTIS; INIS; GPO Dep.

A calculational technique for quantifying the concentration of hydrogen generated by radiolysis in sealed radioactive waste containers was developed in a U.S. Department of Energy (DOE)

study conducted by EG&G Idaho, Inc., and the Electric Power Research Institute (EPRI) TMI-2 Technology Transfer Office. The study resulted in report GEND-041, entitled "A Calculational Technique to Predict Combustible Gas Generation in Sealed Radioactive Waste Containers". The study also resulted in a presentation to the U.S. Nuclear Regulatory Commission (NRC) which gained acceptance of the methodology for use in ensuring compliance with NRC IE Information Notice No. 84-72 (NRC 1984) concerning the generation of hydrogen within packages. NRC IE Information Notice No. 84-72: "Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation" applies to any package containing water and/or organic substances that could radiolytically generate combustible gases. EPRI developed a simple computer program in a spreadsheet format utilizing GEND-041 calculational methodology to predict hydrogen gas concentrations in low-level radioactive wastes containers termed Radcalc. The computer code was extensively benchmarked against TMI-2 (Three Mile Island) EPICOR II resin bed measurements. The benchmarking showed that the model developed predicted hydrogen gas concentrations within 20% of the measured concentrations. Radcalc for Windows was developed using the same calculational methodology. The code is written in Microsoft Visual C++ 2.0 and includes a Microsoft Windows compatible menu-driven front end. In addition to hydrogen gas concentration calculations, Radcalc for Windows also provides transportation and packaging information such as pressure buildup, total activity, decay heat, fissile activity, TRU activity, and transportation classifications.

20856 (WHC-SA–2865) **Early containment of high-alkaline solution simulating low-level radioactive waste stream in clay-bearing blended cement.** Kruger, A.A. (Westinghouse Hanford Co., Richland, WA (United States)); Olson, R.A.; Tennis, P.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013576. Source: OSTI; NTIS; INIS; GPO Dep.

Portland cement blended with fly ash and attapulgite clay was mixed with high-alkaline solution simulating low-level radioactive waste stream at a one-to-one weight ratio. Mixtures were adiabatically and isothermally cured at various temperatures and analyzed for phase composition, total alkalinity, pore solution chemistry, and transport properties as measured by impedance spectroscopy. Total alkalinity is characterized by two main drops. The early one corresponds to a rapid removal of phosphorous, aluminum, sodium, and to a lesser extent potassium solution. The second drop from about 10 h to 3 days is mainly associated with the removal of aluminum, silicon, and sodium. Thereafter, the total alkalinity continues descending, but at a lower rate. All pastes display a rapid flow loss that is attributed to an early precipitation of hydrated products. Hemicarbonate appears as early as one hour after mixing and is probably followed by apatite precipitation. However, the former is unstable and decomposes at a rate that is inversely related to the curing temperature. At high temperatures, zeolite appears at about 10 h after mixing. At 30 days, the stabilized crystalline composition includes zeolite, apatite and other minor amounts of $CaCO_3$, quartz, and monosulfate Impedance spectra conform with the chemical and mineralogical data. The normalized conductivity of the pastes shows an early drop, which is followed by a main decrease from about 12 h to three days. At three days, the permeability of the cement-based waste as calculated by Katz-Thompson equation is over three orders of magnitude lower than that of ordinary portland cement paste. However, a further decrease in the calculated permeability is questionable. Chemical stabilization is favorable through incorporation of waste species into apatite and zeolite.

20857 (WHC-SD-534-CSWD–005-Rev.2) **242-A Control System device logic software documentation. Revision 2.** Berger, J.F. Westinghouse Hanford Co., Richland, WA (United States). 19 May 1995. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013342. Source: OSTI; NTIS; INIS; GPO Dep.

A Distributive Process Control system was purchased by Project B-534. This computer-based control system, called the Monitor and Control System (MCS), was installed in the 242-A Evaporator located in the 200 East Area. The purpose of the MCS is to monitor and control the Evaporator and Monitor a number of alarms and other signals from various Tank Farm facilities. Applications software for the MCS was developed by the Waste Treatment System Engineering Group of Westinghouse. This document describes the Device Logic for this system.

20858 (WHC-SD-CP-OCD–040-Rev.1) **Basis document for sludge stabilization. Revision 1.** Dayley, L. Westinghouse Hanford Co., Richland, WA (United States). 5 Apr 1995. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010701. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the technical basis for the operating specifications to be used in the Sludge Stabilization Process at the Plutonium Finishing Plant.

20859 (WHC-SD-CP-QAPP–017) **Quality Assurance Program Plan for the Waste Sampling and Characterization Facility.** Grabbe, R.R. Westinghouse Hanford Co., Richland, WA (United States). 2 Mar 1995. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95008870. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this Quality Assurance Plan is to provide quality assurance (QA) guidance, implementation of regulatory QA requirements, and quality control (QC) specifications for analytical service. This document follows the Department of Energy (DOE)-issued Hanford Analytical Services Quality Assurance Plan (HASQAP) and additional federal [10 US Code of Federal Regulations (CFR) 830.120] QA requirements that HASQAP does not cover. This document describes how the laboratory implements QA requirements to meet the federal or state requirements, provides what are the default QC specifications, and/or identifies the procedural information that governs how the laboratory operates. In addition, this document meets the objectives of the Quality Assurance Program provided in the WHC-CM-4-2, Section 2.1. This document also covers QA elements that are required in the Guidelines and Specifications for Preparing Quality Assurance Program Plans (QAPPs), (QAMS-004), and Interim Guidelines and Specifications for Preparing Quality Assurance Product Plans (QAMS-005) from the Environmental Protection Agency (EPA). A QA Index is provided in the Appendix A.

20860 (WHC-SD-FL-MAR–001) **308 Building deactivation mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013900. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the 308 Building (Fuels Development Laboratory) Deactivation Project mission analysis. Hanford systems engineering (SE) procedures call for a mission analysis. The mission analysis is an important first step in the SE process. The functions and requirements to successfully accomplish this mission, the selected alternatives and products will later be defined using the SE process.

20861 (WHC-SD-FL-MAR–002) **300 Area fuel supply facilities deactivation mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013882. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the 300 Area fuel supply facilities (formerly call "N reactor fuel fabrication facilities") Deactivation Project mission analysis. Hanford systems engineering (SE) procedures call for a mission analysis. The mission analysis is an important first step in the SE process.

20862 (WHC-SD-NR-ISB–001) **Interim safety basis for fuel supply shutdown facility.** Brehm, J.R.; Deobald, T.L.; Benecke, M.W.; Remaize, J.A. Westinghouse Hanford Co., Richland, WA (United States). 23 May 1995. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013349. Source: OSTI; NTIS; INIS; GPO Dep.

This ISB in conjunction with the new TSRs, will provide the required basis for interim operation or restrictions on interim operations and administrative controls for the Facility until a SAR is prepared in accordance with the new requirements. It is concluded that the risk associated with the current operational mode of the Facility, uranium closure, clean up, and transition activities required for permanent closure, are within Risk Acceptance Guidelines. The Facility is classified as a Moderate Hazard Facility because of the potential for an unmitigated fire associated with the uranium storage buildings.

20863 (WHC-SD-SNF-ATR–004) **Acceptance test procedure for the 105-KW isolation barrier leak rate.** McCracken, K.J. Westinghouse Hanford Co., Richland, WA (United States). 19 May 1995. 292p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013345. Source: OSTI; NTIS; INIS; GPO Dep.

This acceptance test procedure shall be used to: First establish a basin water loss rate prior to installation of the two isolation barriers between the main basin and the discharge chute in K-Basin West. Second, perform an acceptance test to verify an acceptable leakage rate through the barrier seals. This Acceptance Test Procedure (ATP) has been prepared in accordance with CM-6-1 EP 4.2, Standard Engineering Practices.

20864 (WHC-SD-SNF-TRP–007) **105K West Isolation Barrier Acceptance Test results.** McCracken, K.J. (ICF Kaiser Hanford Co., Richland, WA (United States)); Irwin, J.J. ICF Kaiser Hanford Co., Richland, WA (United States). 18 May 1995. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013343. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this document is to report and interpret the findings of the isolation barrier acceptance tests performed in 105KW/100K. The tests were performed in accordance with the test plan and acceptance test procedure. The test report contains the test data. This document compares the test data against the criteria. A discussion of the leak rate analytical characterization describes how the flow characteristics flow rate will be determined using the test data from the test report. Two modes of water loss were considered; basin and/or discharge chute leakage, and evaporation. An initial test established baseline leakage data and instrumentation performance. Test 2 evaluated the sealing performance of the isolation barrier by inducing an 11 in. (27.9 cm) level differential across the barrier. The leak rate at this 11 in. (27.9 cm) level is extrapolated to the 16 ft. (4.9 m) level differential postulated in the DBE post seismic event. If the leak rate, adjusted for evaporation and basin leakage (determined from Test 1), is less than the SAR limit of 1,500 gph (5,680 lph) at a 16 ft (4.9 m) level differential, the barriers pass the acceptance test.

20865 (WHC-SD-SP-MAR–001) **309 Building deactivation mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013884. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the 309 Building (Plutonium Fuels Utilization Program) Deactivation Project mission analysis. Hanford systems engineering (SE) procedures call for a mission analysis. The mission analysis is an important first step in the SE process. The functions and requirements to successfully accomplish this mission, the selected alternatives and products will later be defined using the SE process.

20866 (WHC-SD-SQA-CSWD–20022) **ABAQUS 5.4 software configuration.** Marlow, R.S. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012793. Source: OSTI; NTIS; GPO Dep.

ABAQUS 5.4 is a powerful general purpose finite-element computer program for the radioactive waste tank program. This document describes the verification and validation of ABAQUS 5.4 as installed on the Scientific and Engineering Computing Center.

20867 (WHC-SD-W026-PLN–007) **WRAP module 1 treatment plan.** Mayancsik, B.A. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012952. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the methodology to treat waste in the Waste Receiving and Processing Module 1 facility to meet the Resource Conservation and Recovery Act (RCRA) land disposal restrictions or the Waste Isolation and Pilot Plant waste acceptance criteria. This includes Low-Level Mixed Waste, Transuranic Waste, and Transuranic Mixed Waste.

20868 (WHC-SD-W030-ATP–003) **Acceptance Test Procedure for Cathodic Protection, Rectifier 11.** Clifton, F.T. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011634. Source: OSTI; NTIS; INIS; GPO Dep.

This Acceptance Test Procedure for Project W-030 Cathodic Protection Installation, 241-AY and 241-AZ Tank Farm Ventilation Upgrade, has been prepared to demonstrate that the cathodic protection system functions as required by project criteria.

20869 (WHC-SD-W105-SWD–1-Rev.1) **242-A/LERF programmable Logic Controller Ladder. Revision 1.** Teats, M.C. Westinghouse Hanford Co., Richland, WA (United States). 23 May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013905. Source: OSTI; NTIS; GPO Dep.

This document defines and describes the user-generated application software written to transmit digital and analog signals from the Liquid Effluent Retention Facility (LERF) to the 242-A Evaporator Distributed Control System (DCS). PLCs and modems were installed in the 242-A Evaporator by Project W-105 (LERF) to transmit 6 analog liquid level signals, 6 range alarms based on the analog signals, and 6 leak detection and pump status signals to the 242-A Distributive Control System (DCS) from LERF. Communications between the two facilities are also monitored and alarm on the DCS. Following the Project W-105 completion, the communications and signal mix were modified by Project C-018H (ETF). The current PLC software (including ladder logic and data tables), PLC hardware settings, and modem option settings to transmit the signals and monitor communications are documented and described in this document.

20870 (WHC-SD-W236A-EL–002) **Safety equipment list.** Lavender, J.C. (Westinghouse Hanford Co., Richland, WA (United States)); Roe, N.A. Westinghouse Hanford Co., Richland, WA (United States); ICF Kaiser Hanford Co., Richland, WA (United States). 13 Apr 1995. 607p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010764. Source: OSTI; NTIS; GPO Dep.

This analysis assigns preliminary safety class (SC) designations to major systems and structures associated with the Multi-Function Waste Tank Facility (MWTF) project in accordance with the Multi-Function QAPP, W-236A (Hall 1994). Also included are SC assignments for those subsystems and major components of the major systems discussed in this document (see Appendices A and B). Component safety classifications have been completed through inspection (using engineering judgement) for simple systems, and through use of logic models (i.e., fault trees) for complicated systems. This analysis is intended to augment the SC systems list supplied in Chapter 9 of the MWTF Preliminary Safety Analysis Report (WHC 1994). Whereas WHC (1994) only addresses select systems, this analysis addresses the SC ramifications of all MWTF systems and structures as identified in the Title 1 design media. This document provides additional analyses of the system safety classifications assignments, and classifies systems not addressed in WHC (1994). This analysis specifically describes the safety functions) that must be performed by each MWTF system.

20871 (WHC-SD-W236A-ER–013) **Concrete material characterization reinforced concrete tank structure Multi-Function Waste Tank Facility.** Winkel, B.V. Westinghouse Hanford Co., Richland, WA (United States). 3 Mar 1995. 92p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95008864. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to document the Multi-Function Waste Tank Facility (MWTF) Project position on the concrete mechanical properties needed to perform design/analysis calculations for the MWTF secondary concrete structure. This report provides a position on MWTF concrete properties for the Title 1 and Title 2 calculations. The scope of the report is limited to mechanical properties and does not include the thermophysical properties of concrete needed to perform heat transfer calculations. In the 1970's, a comprehensive series of tests were performed at Construction Technology Laboratories (CTL) on two different Hanford concrete mix designs. Statistical correlations of the CTL data were later generated by Pacific Northwest Laboratories (PNL). These test results and property correlations have been utilized in various design/analysis efforts of Hanford waste tanks. However, due to changes in the concrete design mix and the lower range of MWTF operating temperatures, plus uncertainties in the CTL data and PNL correlations, it was prudent to evaluate the CTL data base and PNL correlations, relative to the MWTF application, and develop a defendable position. The CTL test program for Hanford concrete involved two different mix designs: a 3 kip/in^2 mix and a 4.5 kip/in^2 mix. The proposed 28-day design strength for the MWTF tanks is 5 kip/in^2. In addition to this design strength difference, there are also differences between the CTL and MWTF mix design details. Also of interest, are the appropriate application of the MWTF concrete properties in performing calculations demonstrating ACI Code compliance. Mix design details and ACI Code issues are addressed in Sections 3.0 and 5.0, respectively. The CTL test program and PNL data correlations focused on a temperature range of 250 to 450 F. The temperature range of interest for the MWTF tank concrete application is 70 to 200 F.

20872 (WHC-SD-W236A-ER–018-Rev.1) **MWTF, material selection for insulating/supporting pad letter report. Revision 1.** Stine, M.D. Westinghouse Hanford Co., Richland, WA (United States). 25 Apr 1995. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010939. Source: OSTI; NTIS; INIS; GPO Dep.

The Multi-Function Waste Tank Facility (MWTF) consists of six 1.1 6 million on underground double-shell waste storage tanks and associated systems. Four of the tanks will be located approximately 2,000 feet west of the western boundary of the 200-East Area of the Hanford Site; two tanks will be located in the southeast corner of the 200-West Area. These tanks will provide storage of mixed hazardous waste. Revision 0 of this report was completed in July of 1993. Since that time, the design of the tanks has changed to using carbon steel for the primary tank and secondary liner (ref 1) in lieu of stainless steel. This means that the primary tank will require postwe d heat treatment (PWHT) at a temperature of 1100°F. In addition, scoping calculations of the temperature distributions in the supporting pad indicate that pad insulating properties have a significant effect on the temperatures experienced by the piping embedded in the pad and the concrete foundation slab during PWHT. Each double-shell tank will be comprised of two main structures: an outer structure made of reinforced concrete and lined with a carbon steel secondary liner, and an inner primary storage tank that is a completely enclosed carbon steel ASME Section III vessel. An annular space will separate the carbon steel secondary liner from the primary storage tank. An insulating/supporting pad will be placed between the bottom of the secondary liner and the bottom of the primary storage tank. The existing double-shell tanks at the Hanford Site were constructed with an insulating castable refractory material at this location. This refractory material was used to protect the tank foundation from the high temperatures produced during the PWHT operation for the carbon steel primary storage tanks. This letter report provides the basis for material selection for the insulating/supporting pad to be used on this project.

20873 (WHC-SD-W236A-ER–021-Rev.1) **Multi-Function Waste Tank Facility phase out basis. Revision 1.** Awadalla, N.G. Westinghouse Hanford Co., Richland, WA (United States). 20 Apr 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011544. Source: OSTI; NTIS; INIS; GPO Dep.

Additional double-shell tank storage capacity is not needed until FY 2004 or later. The waste volume in the current baseline program can be managed within the existing tank capacity. However, this requires implementation of some risk management actions and significant investment in software and hardware to accomplish the actions necessary to maximize use of existing storage tank space."

20874 (WHC-SD-W236A-ER–022) **Using tank 107-AN caustic addition for confirmation of mixing scale relationship.** Chang, S.C. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012792. Source: OSTI; NTIS; INIS; GPO Dep.

A subscale jet mixing program was carried out in two scale tanks to extend the basis of previous subscale tests to include in-tank geometry associated with tank AN-107. The laboratory data will be correlated with the data to be collected in the upcoming tank AN-107 mixing and caustic addition test. The objective is to verify the scaling relationship used in the MWTF mixer design.

20875 (WHC-SD-W236A-ES–015) **Waste segregation analysis for salt well pumping in the 200 W Area – Task 3.4.** Reynolds, D.A. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011676. Source: OSTI; NTIS; INIS; GPO Dep.

There is an estimated 7 million liters (1.9 million gallons) of potentially complexed waste that need to be pumped from single-shell tanks (SST) in the 200 West Area. This represents up to 40% of the salt well liquor that needs to be pumped in the 200 West Area. There are three double-shell (DST) tanks in the 241-SY tank farm in the 200 West Area. Tank 241-SY-101 is full and not usable. Tank 241-SY-102 has a transuranic (TRU) sludge in the bottom. Current rules prohibit mixing complexed waste with TRU waste. Tank 241-SY-103 has three major problems. First, 241-SY-103 is on the Flammable Watch list. Second, adding waste to tank 241-SY-103 has the potential for an episodic release of hydrogen gas. Third, 241-SY-103 will not hold all of the potentially complexed waste from the SSTs. This document looks at more details regarding the salt well pumping of the 200 West Area tank farm. Some options are considered but it is beyond the scope of this document to provide an in-depth study necessary to provide a defensible solution to the complexed waste problem.

20876 (WHC-SD-W236A-TI–020) **Position paper: Seismic design criteria.** Farnworth, S.K. Westinghouse Hanford Co., Richland, WA (United States). 22 May 1995. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013338. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to document the seismic design criteria to be used on the Title 11 design of the underground double-shell waste storage tanks and appurtenant facilities of the Multi-Function Waste Tank Facility (MWTF) project, and to provide the history and methodologies for determining the recommended Design Basis Earthquake (DBE) Peak Ground Acceleration (PGA) anchors for site-specific seismic response spectra curves. Response spectra curves for use in design are provided in Appendix A.

20877 (WHC-SD-W236A-TS–001) **Project W-236A multi-function waste tank facility waste feed projections.** Larrick, A.P. Westinghouse Hanford Co., Richland, WA (United States). 22 Dec 1994. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95006597. Source: OSTI; NTIS; INIS; GPO Dep.

A review of Hanford Underground Waste Storage Tank Chemistry, coupled with planned remediation actions and retrieval sequences was conducted in order to predict the chemistry of the waste to be stored in the MWTF tanks. All projected waste solutions to be transferred to the MWTF tanks were found to be in compliance with current tank chemistry specifications; therefore, the waste and the tank materials of construction are expected to be compatible.

20878 (WHC-SD-W320-DA–007) **Structural analysis of the Heel Jet secondary catch mechanism.** Coverdell, B.L. Westinghouse Hanford Co., Richland, WA (United States). 17 Apr 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010573. Source: OSTI; NTIS; INIS; GPO Dep.

Studies of the Heel Jet Pump lifting bail weld indicate that the weld process and/or weld material used may be incompatible with the base metal. For this reason, a backup design for hoist of the Heel Jet Pump is necessary. By using a 0.0508 m (2 in.) and 0.0762 m (3 in.) jumper connector in conjunction with the existing lifting bail the Heel Jet Pump can be safely hoisted.

20879 (WHC-SD-W378-DRD–001) **Preliminary design requirements document for Project W-378, low-level waste vitrification plant.** Swanson, L.M. Westinghouse Hanford Co., Richland, WA (United States). 31 Mar 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010676. Source: OSTI; NTIS; INIS; GPO Dep.

The scope of this preliminary Design Requirements Document (DRD) is to identify and define the functions, with associated requirements, which must be performed to accomplish vitrification and disposal of the pretreated low-level waste (LLW) fraction of the Hanford Site tank waste. This document sets forth function requirements, performance requirements and design constraints necessary to begin conceptual design for the Low-Level Waste Vitrification Plant (LLWVP). System and physical interfaces between the LLWVP Project and the Tank Waste Remediation System (TWRS) are identified. The constraints, performance requirements, and transfer of information and data across a technical interface will be documented in an Interface Control Document. The design requirements provided in this document will be augmented by additional detailed design data to be documented by the project.

20880 (WHC-SD-W430-FDC–001) **Functional design criteria SY tank farm cathodic protection, 95G-EWW-430.** Edgemon, G.L. Westinghouse Hanford Co., Richland, WA (United States). 13 Apr 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012794. Source: OSTI; NTIS; INIS; GPO Dep.

Functional Design Criteria (FDC) for Project W-430 describing cathodic protection system completion in 241-SY tank farm.

20881 (WHC-SD-WM-ATP–077-Rev.3) **Enraf series 854 Advanced Technology Gauge (ATG) acceptance test procedure. Revision 3.** Barnes, G.A. Westinghouse Hanford Co., Richland, WA (United States). 8 May 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012826. Source: OSTI; NTIS; INIS; GPO Dep.

This procedure provides acceptance testing for Enraf Series 854 level gauges used to monitor levels in Hanford Waste Storage Tanks. The test will verify that the gauge functions according to the manufacturer's instructions and specifications and is properly setup prior to being delivered to the tank farm area.

20882 (WHC-SD-WM-ATP–128) **Operator coil monitoring Acceptance Test Procedure.** Erhart, M.F. Westinghouse Hanford Co., Richland, WA (United States). 16 May 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013362. Source: OSTI; NTIS; INIS; GPO Dep.

The readiness of the Data Acquisition and Control System (DACS) to provide monitoring and control of the Programmable Logic Controller (PLC) abort coils from the Master and RSS stations will be systematically tested during performance of this procedure. It should be noted that these are not physical abort coils but software coils controlled by the software's ladder logic. The readiness of the DACS to properly interface with the ENRAF wire level gauge installed in the SY-101 storage tank will also be tested. During this test, a verification of all abort coil indications will be conducted at the DACS Development Facility in the 306E Building by injecting an input signal for each DACS sensor that has an associated abort coil until the abort coil actuates, and then ensuring that the status of the abort coil indicated at the Master and RSS stations is correct. Each abort coil will also be tested to ensure that the "ENABLE" and "DISABLE" controls from the Master and RSS stations function correctly, and only with the use of proper passwords.

20883 (WHC-SD-WM-ATR–090) **Standard-B auto grab sampler hydrogen monitoring system, Acceptance Test Report.** Lott, D.T. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 799p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013364. Source: OSTI; NTIS; INIS; GPO Dep.

Project W-369, Watch List Tank Hydrogen Monitors, installed a Standard-C Hydrogen Monitoring System (SHMS) on the Flammable gas waste tank AN-104. General Support Projects (8K510) was support by Test Engineering (7CH30) in the performance of the Acceptance Test Procedures (ATP) to qualify the SHMS cabinets on the waste tank. The ATP's performance was controlled by Tank Farm work package. This completed ATP is transmitted by EDT-601748 as an Acceptance Test Report (ATR) in accordance with WHC-6-1, EP 4.2 and EP 1.12.

20884 (WHC-SD-WM-ATR–129) **Void fraction instrument software, Version 1,2, Acceptance test report.** Gimera, M. Westinghouse Hanford Co., Richland, WA (United States). 9 May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013328. Source: OSTI; NTIS; INIS; GPO Dep.

This provides the report for the void fraction instrument acceptance test software Version 1.2. The void fraction will collect data that will be used to calculate the quantity of gas trapped in waste tanks.

20885 (WHC-SD-WM-ATR–130) **Viscometer software, Version 1.1, Acceptance test report.** Gimera, M. Westinghouse Hanford Co., Richland, WA (United States). 9 May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013327. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents results of the acceptance test for the software that was developed to operate the viscometer, which is the instrument that will collect ball rheometry data for Tank 101-SY.

20886 (WHC-SD-WM-DP–104) **45-Day safety screen results for Tank 241-BY-103, auger samples 95-AUG-012 and 95-AUG-013.** Schreiber, R.D. Westinghouse Hanford Co., Richland, WA (United States). 21 Apr 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011448. Source: OSTI; NTIS; INIS; GPO Dep.

Two auger samples from tank 241-BY-103 (BY-103) were received by the 222-S Laboratories and underwent safety screening analysis, consisting of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha activity. Analytical results for the TGA analyses for both samples were less than the safety screening notification limit. Since notification is made if the sample is analyzed at less than 17% water, notification was made on April 20, 1995. Although the sample results were below this limit, no secondary analyses were required or performed. Included in this report are the primary safety screening results obtained from the analyses and copies of all DSC and TGA raw data scans as requested per the TCP. Photographs of the auger samples were taken during extrusion and, although not included in this report, are available. Tank BY-103 is on the ferrocyanide Watch List.

20887 (WHC-SD-WM-DP–108) **45-Day safety screen results for tank 241-C-105, push mode, cores 72 and 76.** Sasaki, L.M. Westinghouse Hanford Co., Richland, WA (United States). 3 May 1995. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012834. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a report of the analytical results for samples collected between March 14 and March 22, 1995 from the radioactive wastes in Tank 241-C-105 at the Hanford Reservation. Core samples were collected from the solid wastes in the tank and underwent safety screening analyses including differential scanning calorimetry, thermogravimetric analysis, and total alpha analysis.

20888 (WHC-SD-WM-DP–109) **45-Day safety screen results for tank 241-U-203, push mode, cores 79 and 80.** Schreiber,

R.D. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012837. Source: OSTI; NTIS; INIS; GPO Dep.

Two one-segment core samples from tank 241-U-203 (U-203) were received by the 222-S Laboratories and underwent safety screening analysis, consisting of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha activity. In addition to the safety screening requirements, inductively coupled plasma (ICP) spectrographic analysis for lithium was performed to determine the extent of hydrostatic head fluid contamination during the sampling event. No notification limits were exceeded for these analyses.

20889 (WHC-SD-WM-DP–110) **45-Day safety screen results for tank 241-U-202, push mode, cores 75 and 78.** Jo, J. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012833. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a report of the analytical results for samples collected from the radioactive wastes in Tank 241-U-202 at the Hanford Reservation. Core samples were collected from the solid wastes in the tank and underwent safety screening analyses including differential scanning calorimetry, thermogravimetric analysis, and total alpha analysis. Results indicate that no safety screening notification limits were exceeded.

20890 (WHC-SD-WM-DP–112) **45-day safety screen results and final report for Tank 241-C-203, Auger samples 95 AUG-020 and 95-AUG-021.** Conner, J.M. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013365. Source: OSTI; NTIS; INIS; GPO Dep.

This document serves as the 45-day report deliverable for the tank C-203 auger samples collected on April 5, 1995 (samples 95-AUG-20 and 95-AUG-021). As no secondary analyses were required and no other analyses have been requested, this document also serves as the final report for C-203 auger sampling. Each sample was received, extruded, and analyzed by the 222-S Laboratories in accordance with the Tank Characterization Plan (TCP) referenced below. Included in this report are the primary safety screening results (DSC, TGA, and alpha) and density results. The worklists and raw data are included in this report. Photographs of the auger samples were taken during extrusion and, although not included in this report, are available.

20891 (WHC-SD-WM-DP–113) **45-day safety screen results for tank 241-U-204, push mode, cores 81 and 82.** Bell, K.E. Westinghouse Hanford Co., Richland, WA (United States). 17 May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013346. Source: OSTI; NTIS; INIS; GPO Dep.

This is the 45-Day report for the fiscal year 1995 tank 241-U-204 (U-204) push-mode characterization effort. Included are a summary of analytical results and copies of the differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA) scans. Core samples 81 and 82 from tank U-204, obtained by the push-mode core sampling method, were received by the 222-S Laboratories. Each core consisted of only one segment. Both core samples and the field blank were extruded, subsampled, and analyzed in accordance with Reference 1. Drainable liquids and the field blank were analyzed at the segment level for energetics by DSC, percent water by TGA, and total organic carbon (TOC) by furnace oxidation. In addition, the presence or absence of any separable, presumably organic, layer in drainable liquid samples was noted and none was observed. The solids were analyzed directly at the half segment level for energetics by DSC, percent water by TGA, and TOC by persulfate oxidation. Total alpha activity was determined on fusion digestions of the sludge subsamples. No immediate notifications were necessary on samples from cores 81 or 82.

20892 (WHC-SD-WM-DP–130) **Equipment sizing calculations for the Extensive Separations Alternative engineering data package.** Jansen, G. Jr. Westinghouse Hanford Co., Richland, WA (United States). 6 Apr 1995. 383p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010945. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains results of Raytheon/BNFL calculations for equipment selection and sizing for the Extensive Separations Alternative to be evaluated in the TWRS- (Tank Waste Remediation System) Environmental Impact Statement. This report contains: an equipment list for the extensive separations/HLW Facility; calculation of equipment sizing for HLW vitrification system; calculation for centrifuge selection; calculation of equipment sizing for fractionator, absorbers, reboiler, and condenser; calculation of equipment sizing for ion exchange columns; calculation of equipment sizing for tanks; calculation of equipment sizing for bulk, preparation, and feed cold chemical tanks; calculation of equipment sizing for evaporators, condensers, tanks, decanters, and filters; calculation of equipment sizing for organics destruction system; and calculation of LLW facility throughput and equipment sizes.

20893 (WHC-SD-WM-DQO–002-Rev.1) **Data quality objectives for generic in-tank health and safety vapor issue resolution. Revision 1.** Osborne, J.W. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012797. Source: OSTI; NTIS; INIS; GPO Dep.

Data Quality Objectives (DQOs) for generic waste storage tank vapor and gas sampling were developed in facilitated meetings and a stakeholder review session, using the most recent US EPA DQO guidelines. These meetings elicited DQOs for two major vapor problem areas: flammability and toxicity. This is a summary of the outputs of the planning team for each of the 7 steps of the DQO process.

20894 (WHC-SD-WM-DQO–006-Rev.1) **Data quality objective to support resolution of the organic fuel rich tank safety issue.** Buckley, L.L. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011633. Source: OSTI; NTIS; INIS; GPO Dep.

During years of Hanford process history, large quantities of complexants used in waste management operations as well as an unknown quantity of degradation products of the solvents used in fuel reprocessing and metal recovery were added to man of the 149 single-shell tanks. These waste tanks also contain a presumed stoichiometric excess of sodium nitrate/nitrite oxidizers, sufficient to exothermically oxidize the organic compounds if suitably initiated. This DQO identifies the questions that must be answered to appropriately disposition organic watchlist tanks, identifies a strategy to deal with false positive or negative judgements associated with analytical uncertainty, and list the analytes of concern to support dealing with organic watchlist concerns. Uncertainties associated with both assay limitations and matrix effects complicate selection of analytes. This results in requiring at least two independent measures of potential fuel reactivity.

20895 (WHC-SD-WM-DQO–007-Rev.1) **Data requirements for the Ferrocyanide Safety Issue developed through the data quality objectives process. Revision 1.** Meacham, J.E.; Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012787. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the requirements for obtaining tank characterization information to support resolution of the Ferrocyanide Safety Issue at the Hanford Site by applying the data quality objectives (DQO) process. A strategy describing the overall approach to safe storage and disposal of the waste in the ferrocyanide tanks identifies the problems and decisions that require characterization data. The DQO process is applied to each decision or group of related decisions to specify data requirements.

20896 (WHC-SD-WM-DQO–018) **Historical model evaluation data requirements.** Simpson, B.C.; McCain, D.J. Westinghouse Hanford Co., Richland, WA (United States). 8 May 1995. 22p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE95012827. Source: OSTI; NTIS; INIS; GPO Dep.

Several studies about tank waste contents have been published using historical records of tank transactions and various analytical measurements. While these records offer a wealth of information, the results are questionable until error estimates associated with the results can be established. However, they do provide a direction for investigation. Two principal observations from the studies are: (1) Large quantities of individual waste types from the various separations processes were widely distributed throughout the tank farms, and (2) The compositions of many of these waste types are quite distinct from one another. A key assumption associated with these observations is that the effects of time and location on the tank wastes are either nominal or not discernable. Since each waste type has a distinct composition, it would benefit all programs to better quantify that composition, and establish an uncertainty for each element of that composition. Various process, disposal, or other decisions could then be made based on current information reducing the need for extended sampling and analysis.

20897 (WHC-SD-WM-ER-400-Vol.1) **Tank waste source term inventory validation. Volume 1. Letter report.** Brevick, C.H.; Gaddis, L.A.; Johnson, E.D. ICF Kaiser Hanford Co., Richland, WA (United States). 28 Apr 1995. 505p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012488. Source: OSTI; NTIS; INIS; GPO Dep.

The sample data for selection of 11 radionuclides and 24 chemical analytes were extracted from six separate sample data sets, were arranged in a tabular format and were plotted on scatter plots for all of the 149 single-shell tanks, the 24 double-shell tanks and the four aging waste tanks. The solid and liquid sample data was placed in separate tables and plots. The sample data and plots were compiled from the following data sets: characterization raw sample data, recent core samples, D. Braun data base, Wastren (Van Vleet) data base, TRAC and HTCE inventories. This document is Volume I of the Letter Report entitled Tank Waste Source Term Inventory Validation.

20898 (WHC-SD-WM-ER-400-Vol.2) **Tank waste source term inventory validation. Volume II. Letter report.** ICF Kaiser Hanford Co., Richland, WA (United States). Apr 1995. 880p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012489. Source: OSTI; NTIS; INIS; GPO Dep.

This document comprises Volume II of the Letter Report entitled Tank Waste Source Term Inventory Validation. This volume contains Appendix C, Radionuclide Tables, and Appendix D, Chemical Analyte Tables. The sample data for selection of 11 radionuclides and 24 chemical analytes were extracted from six separate sample data sets, were arranged in a tabular format and were plotted on scatter plots for all of the 149 single-shell tanks, the 24 double-shell tanks and the four aging waste tanks. The solid and liquid sample data was placed in separate tables and plots. The sample data and plots were compiled from the following data sets: characterization raw sample data, recent core samples, D. Braun data base, Wastren (Van Vleet) data base, TRAC and HTCE inventories.

20899 (WHC-SD-WM-ER-418-Rev.1) **Tank 241-BY-104 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013567. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-104 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-104 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20900 (WHC-SD-WM-ER-419-Rev.1) **Tank 241-BY-105 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013566. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-105 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-105 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20901 (WHC-SD-WM-ER-420-Rev.1) **Tank 241-BY-106 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013595. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-106 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-106 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20902 (WHC-SD-WM-ER-421) **Tank 241-BY-107 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012831. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-107 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues". Tank 241-BY-107 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution".

20903 (WHC-SD-WM-ER-421-Rev.1) **Tank 241-BY-107 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013594. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-107 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-107 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20904 (WHC-SD-WM-ER-422-Rev.1) **Tank 241-BY-108 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014304. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-108 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues" (Osborne and Huckaby 1994). Tank 241-BY-108 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution (Osborne et al., 1994).

20905 (WHC-SD-WM-ER-423) **Tank 241-C-108 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 16p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE95012832. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-108 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in Program Plan for the Resolution of Tank Vapor Issues (Osborne and Huckaby 1994). Tank 241-C-108 was vapor sampled in accordance with Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution (Osborne et al., 1994).

20906 (WHC-SD-WM-ER–423-Rev.1) **Tank 241-C-108 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013569. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-108 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-C-108 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20907 (WHC-SD-WM-ER–424) **Tank 241-C-109 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012830. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-109. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20908 (WHC-SD-WM-ER–424-Rev.1) **Tank 241-C-109 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013561. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank C-109. The drivers and objectives of the waste tank headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports.

20909 (WHC-SD-WM-ER–425-Rev.1) **Tank 241-C-111 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013559. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-111. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20910 (WHC-SD-WM-ER–426-Rev.1) **Tank 241-C-112 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Pacific Northwest Lab., Richland, WA (United States). 31 May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013565. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-112 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-C-112 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20911 (WHC-SD-WM-ER–429-Rev.1) **Tank 241-BY-110 vapor sampling and analysis tank characterization report. Revision 1.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013907. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-BY-110. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to the tank farm workers due to fugitive emissions from the tank.

20912 (WHC-SD-WM-ER–434) **Engineering report of plasma vitrification of Hanford tank wastes.** Hendrickson, D.W. Westinghouse Hanford Co., Richland, WA (United States). 12 May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013324. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides an analysis of vendor-derived testing and technology applicability to full scale glass production from Hanford tank wastes using plasma vitrification. The subject vendor testing and concept was applied in support of the Hanford LLW Vitrification Program, Tank Waste Remediation System.

20913 (WHC-SD-WM-ER–438) **Tank 241-B-103 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013896. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-B-103. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20914 (WHC-SD-WM-ER–439) **Tank 241-BX-104 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013897. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-BX-104. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20915 (WHC-SD-WM-ER–440) **Tank 241-BY-111 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013572. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-111 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-111 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20916 (WHC-SD-WM-ER–441) **Tank 241-BY-112 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May

1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013571. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-112 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-112 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20917 (WHC-SD-WM-ER--442) **Tank 241-C-104 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013597. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-104 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-C-104 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20918 (WHC-SD-WM-ER--443) **Tank 241-C-105 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012136. Source: OSTI; INIS; NTIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-105. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20919 (WHC-SD-WM-ER--444) **Tank 241-C-106 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013230. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-106. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20920 (WHC-SD-WM-ER--445) **Tank 241-C-107 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015155. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-107. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20921 (WHC-SD-WM-ER--446) **Tank 241-S-102 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013596. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-S-102 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-S-102 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution. "

20922 (WHC-SD-WM-ER--447) **Tank 241-T-107 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013895. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-T-107. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20923 (WHC-SD-WM-ER--448) **Tank 241-TX-105 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013568. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-TX-105 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-TX-105 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20924 (WHC-SD-WM-ER--449) **Tank 241-TX-118 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013570. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-TX-118 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-TX-118 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20925 (WHC-SD-WM-ER--451) **Tank 241-U-107 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013578. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-U-107 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-U-107 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20926 (WHC-SD-WM-ER--452) **Tank 241-U-111 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013577. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-U-111 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank

farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-U-111 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

20927 (WHC-SD-WM-ER–459) **Tank 241-C-102 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Douglas United Nuclear, Inc., Richland, WA (United States). 31 May 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013562. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-102. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20928 (WHC-SD-WM-ER–460) **Tank 241-SX-106 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013903. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-SX-106. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20929 (WHC-SD-WM-ER–461) **Tank 241-TY-101 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013902. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-TY-101. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20930 (WHC-SD-WM-ER–462) **Tank 241-TY-103 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013898. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-TY-103. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20931 (WHC-SD-WM-ER–463) **Tank 241-TY-104 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013560. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-TY-104. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20932 (WHC-SD-WM-ER–464) **Tank 241-C-110 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013894. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-C-110. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedure that were presented in other reports. The vapor and headspace gas samples were collected and analyzed to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

20933 (WHC-SD-WM-ES–283-Vol.2) **Long-term decontamination engineering study: Appendix A, Appendix B, Appendix C, Appendix D. Volume 2.** Westinghouse Hanford Co., Richland, WA (United States). [1995]. 400p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010931. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains Appendix A,B,C, and D for the Long-Term Decontamination Study and is a compilation of presentations, draft documents, and supporting documents compiled by the Westinghouse Hanford Company T Plant Systems Engineering Team (TPSET). This information was not formally approved, but provides insight into understanding the uncertainty associated with waste stream projections, facility evaluations, and possible alternatives for decontamination/treatment. This information was used in developing and refining the decontamination/treatment alternatives considered in this study.

20934 (WHC-SD-WM-ETP–109) **Pump strongback redesign, pump storage, PM procedures.** Leshikar, G.A.; Desantis, N. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010594. Source: OSTI; NTIS; INIS; GPO Dep.

This Engineering Task Plan describes the requirement for the fabrication of the safety latch, pump PM procedures and spare parts acquisitions.

20935 (WHC-SD-WM-ETP–152) **Engineering Task Plan for Tank 241-C-106 contingency chiller definitive design.** Rensink, G.E.; Kriskovich, J.R. Westinghouse Hanford Co., Richland, WA (United States). 22 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013363. Source: OSTI; NTIS; INIS; GPO Dep.

This document identifies the scope, cost, schedule and responsible organizations for completing a design of a contingency ventilation inlet air cooling system for Tank 241-C-106. The air cooling system, described in Rensink (1995), consists of a chiller, cooling coils, and supporting equipment that, when installed will be capable of assuring that the waste temperatures in Tank 241-C-106 are maintained within acceptable limits for safe storage. The effort described herein is scheduled for completion by May 31, 1995 to support Performance Based Incentive (PBI) Milestone SI-2x.

20936 (WHC-SD-WM-FRD–018) **Functional design criteria for the retained gas sampler system.** Wootan, D.W. Westinghouse Hanford Co., Richland, WA (United States). 12 Apr 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011449. Source: OSTI; NTIS; INIS; GPO Dep.

A Retained Gas Sampler System (RGSS) is being developed to capture and analyze waste samples from Hanford Flammable Gas Watch List Tanks to determine both the quantity and composition of gases retained in the waste. The RGSS consists of three main components: the Sampler, Extractor, and Extruder. This report describes the functional criteria for the design of the RGSS components. The RGSS Sampler is based on the WHC Universal Sampler design with modifications to eliminate gas leakage. The primary function of the Sampler is to capture a representative waste sample from a tank and transport the sample with minimal loss of gas content from the tank to the laboratory. The function of the Extruder is to transfer the waste sample from the Sampler to the Extractor.

The function of the Extractor is to separate the gases from the liquids and solids, measure the relative volume of gas to determine the void fraction, and remove and analyze the gas constituents.

20937 (WHC-SD-WM-ISB–007) **Central waste complex interim safety basis.** Cain, F.G. Westinghouse Hanford Co., Richland, WA (United States). 15 May 1995. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013331. Source: OSTI; NTIS; INIS; GPO Dep.

This interim safety basis provides the necessary information to conclude that hazards at the Central Waste Complex are controlled and that current and planned activities at the CWC can be conducted safely. CWC is a multi-facility complex within the Solid Waste Management Complex that receives and stores most of the solid wastes generated and received at the Hanford Site. The solid wastes that will be handled at CWC include both currently stored and newly generated low-level waste, low-level mixed waste, contact-handled transuranic, and contact-handled TRU mixed waste.

20938 (WHC-SD-WM-MAR–006) **B plant mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013901. Source: OSTI; NTIS; INIS; GPO Dep.

This report further develops the mission for B Plant originally defined in WHC-EP-0722, "System Engineering Functions and Requirements for the Hanford Cleanup Mission: First Issue." The B Plant mission analysis will be the basis for a functional analysis that breaks down the B Plant mission statement into the necessary activities to accomplish the mission. These activities are the product of the functional analysis and will then be used in subsequent steps of the systems engineering process, such as identifying requirements and allocating those requirements to B Plant functions. The information in this mission analysis and the functional and requirements analysis are a part of the B Plant technical baseline.

20939 (WHC-SD-WM-OTP–176) **Operability test procedure for the Rotary Mode Core Sampling System Exhausters 3 and 4.** WSaldo, E.J. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013563. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a procedure for performing operability testing of the Rotary Mode Core Sampling System Exhausters 3 & 4. Upon completion of testing activities an operability testing report will be issued.

20940 (WHC-SD-WM-OTR–171) **Operability test report for the TK-900 effluent monitoring station.** Weissenfels, R.D. Westinghouse Hanford Co., Richland, WA (United States). 6 Apr 1995. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010595. Source: OSTI; NTIS; INIS; GPO Dep.

This operability test report provides the results of the operability test performed on the TK-900 liquid effluent collection system, installed near the east end of the 6 inch chemical sewer header, by Project W-007H. The system is part of BAT/AKART for the BCE liquid effluent stream.

20941 (WHC-SD-WM-PAP–062) **Statements of work for FY 1995 to 2000.** Mann, F.M. Westinghouse Hanford Co., Richland, WA (United States). 26 Apr 1995. 209p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011508. Source: OSTI; NTIS; INIS; GPO Dep.

The activities and tasks needed to successfully prepare an interim, preliminary, and final performance assessment on the disposal of the low-level fraction of Hanford tank wastes are given. Included are analytic, experimental, computational, writing, and approval tasks. These statements of work will be revised annually.

20942 (WHC-SD-WM-RPT–099-Rev.2) **Compliance matrix for the mixed waste disposal facilities, trenches 31 and 34, burial ground 218-W-5. Revision 2.** Johnson, K.D. Westinghouse Hanford Co., Richland, WA (United States). 3 May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012587. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a listing of applicable regulatory requirements to the Mixed Waste Disposal trenches. After the listing of regulations to be followed is a listing of documents that show how the regulations are being implemented and followed for the Mixed Waste trenches.

20943 (WHC-SD-WM-SDD–056) **System design description for the HMT Rotation Motor Heater System.** Vargo, G.F. Jr. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013339. Source: OSTI; NTIS; INIS; GPO Dep.

This document is the design description for the Rotation Motor Heater System on waste tank 241-SY-101. The description includes the certified vendor (CV) file number, operators instructions, and heater sizing calculations.

20944 (WHC-SD-WM-SP–006-Rev.1) **Testing and development strategy for the tank waste remediation system.** Reddick, G.W. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012829. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a strategy for performing radioactive (hot) and nonradioactive testing to support processing tank waste. It evaluates the need for hot pilot plant(s) to support pretreatment and other processing functions and presents a strategy for performing hot test work. A strategy also is provided for nonradioactive process and equipment testing. The testing strategy supports design, construction, startup, and operation of Tank Waste Remediation System (TWRS) facilities.

20945 (WHC-SD-WM-TI–690) **Waste volume reduction factors for potential 242-A evaporator feed.** Sederburg, J.P. Westinghouse Hanford Co., Richland, WA (United States). 4 May 1995. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012790. Source: OSTI; NTIS; INIS; GPO Dep.

Double-shell tank (DST) storage space requirements have been shown to be highly dependent on the end point of 242-A operations. Consequences to the DST of various waste volumes, and concentrations, are evaluated. Only waste streams that are currently planned to be stored in the DST system before the year 2004 are discussed. As of January 1, 1995, approximately 27-million L (7.2-million gal) of dilute wastes are stored in the DSTs available for evaporator processing. Waste streams planned to be transferred to the DSTs before December 31, 2004, are identified. The DST volume for storing slurry from these wastes is presented in this document. At a final slurry specific gravity of ~1.35, 22.5-million L (5.93-million gal) of DST space would be needed on December 31, 2004, to store the product from evaporator processing of these feedstocks. The expected volume needed if the resultant slurry were concentrated to the traditional double-shell slurry feed (DSSF) phase boundary (a specific gravity of ~1.5) would be 17.7-million L (4.67-million gal). An additional 4.8-million L (1.26-million gal) is therefore needed if these wastes are concentrated to a specific gravity of 1.35 instead of the DSSF limit.

20946 (WHC-SD-WM-TP–325) **Tank 241-SX-115 tank characterization plan.** Sasaki, L.M. Westinghouse Hanford Co., Richland, WA (United States). 24 Apr 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012835. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a plan which serves as the contractual agreement between the Characterization Project, Sampling Operations, and WHC 222-S Laboratory. The scope of this plan is to provide guidance for the sampling and analysis of samples for tank 241-SX-115.

20947 (WHC-SD-WM-TP–339) **Tank 241-BX-103 tank characterization plan.** Bell, K.E. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Los Alamos Technical Associates, Inc., Kennewick,

WA (United States). 21 Apr 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011505. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a plan which serves as the contractual agreement between the Characterization Program, Sampling Operations, and WHC 222-S Laboratory. The scope of this plan is to provide guidance for the sampling and analysis of samples for tank 241-BX-103.

20948 (WHC-SD-WM-TP–354) **Tank 241-B-203 tank characterization plan.** Jo, J. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Los Alamos Technical Associates, Inc., Kennewick, WA (United States). 16 May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013366. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the tank characterization plan for waste tank 241-B-203. Topics discussed include: data quality objectives, historical information, and tank status.

20949 (WHC-SD-WM-TP–357) **Test plan for auger sampler improvements.** Francis, P.M. Westinghouse Hanford Co., Richland, WA (United States). 27 Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011510. Source: OSTI; NTIS; INIS; GPO Dep.

At Westinghouse Hanford Company (WHC), one of the functions of the Tank Waste Remediation System (TWRS) division is sampling waste tanks to characterize their contents. The recovery performance of the auger sampler has proven inadequate in certain materials. The current auger configuration relies on cohesion and adhesion (properties dependent on sample media) to retain the sample. The media must maintain its form and stick to the auger flights to recover the sample. Recovery has been satisfactory when sampling in wastes with adequate adhesion and shear strength to overcome the forces of gravity and vibrations associated with retrieval. Multiple variations to the auger design will be tested to determine their ability to increase sample recovery and broaden the sampling capabilities. The designs will be tested in two different media, with the recoveries compared to that of a standard auger sampler. Each design modification will be developed and tested using the method described in this test plan.

20950 (WHC-SD-WM-TP–358) **Tank 241-A-102 tank characterization plan.** Jo, J. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Los Alamos Technical Associates, Inc., Kennewick, WA (United States). 16 May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013368. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the tank characterization plan for waste tank 241-A-102. Topic discussed include: data quality objectives for sampling, safety screening, tank configuration, historical information, and tank status.

20951 (WHC-SD-WM-TSAP–003) **Tank 241-B-203 Push Mode Core Sampling and Analysis Plan.** Jo, J. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Los Alamos Technical Associates, Inc., Kennewick, WA (United States). 16 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013361. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan (SAP) will identify characterization objectives pertaining to sample collection, laboratory analytical evaluation, and reporting requirements in accordance with the Tank Safety Screening Data Quality Objective (Babad and Redus 1994). This Data Quality Objective (DQO) is described in the Tank Characterization Plan (Jo, 1995) for tank 241-B-203 (B-203). This SAP will also identify procedures and requirements for collecting and characterizing samples from tank B-203 by the core sampling method.

20952 (WHC-SD-WM-TSAP–004) **Tank 241-A-102 auger sampling and analysis plan.** Jo, J. Westinghouse Hanford Co., Richland, WA (United States). 16 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013367. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-A-102. The drivers and objectives of the auger sampling and analysis plan were in accordance with procedures that were presented in other reports.

20953 (WHC-SD-WM-UM–030) **ISO-PC Version 1.98: User's guide.** Rittmann, P.D. Westinghouse Hanford Co., Richland, WA (United States). 2 May 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012788. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes how to use Version 1.98 of the shielding program named ISO-PC. Version 1.98 corrects all known errors in ISOSHLD-II. In addition, a few numeric problems have been eliminated. There are three new namelist variables, 25 additional shielding materials, and 5 more energy groups. The two major differences with the original ISOSHLD-II are the removal of RIBD(radioisotope buildup and decay) source generator, and the removal of the non-uniform source distribution parameter, SSV1. This version of ISO-PC works with photon energies from 10 KeV to 10 MeV using 30 energy groups.

20954 (WHC-SD-WM-WP–299) **Work plan for the identification of techniques for in-situ sensing of layering/interfaces of Hanford high level waste tanks.** Vargo, G.F. Jr. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010926. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a plan that describes the activities in a task to conduct an industry survey to determine the existence of currently available hardware and/or concepts for anticipating and/or identifying layering/interfaces within the materials contained in large tanks located on the Hanford Site in Washington State.

20955 (WHC-SP–0969-48) **Site management system executive summary report – March 1995.** Schultz, E.A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013581. Source: OSTI; NTIS; INIS; GPO Dep.

Performance data for March 1995 reflects a continued unfavorable schedule variance and favorable cost variance. The March fiscal-year-to-date (FYTD) schedule variance is an unfavorable $105.5M. EM-30 (Office of Waste Management) is the biggest contributor ($81.9 million) to the behind-schedule condition. The majority of the EM-30 schedule variance is associated with the Tank Waste Remediation System (TWRS) program. A breakdown of individual program performance is listed on page 6. The TWRS schedule variance totals a negative $63.0 million and is attributed to the delay in receiving key decision 0 (KD-0) for Project W-314, "Tank Farm Restoration and Safe Operations"; the delay in receiving KD-3 for Project W-320, "106-C Sluicing"; late deployment of the rotary and push mode sampling trucks due to equipment and operational issues; late placement of melter contracts; and the Multi-Function Waste Tank Facility (MWTF) workscope still being a part of the baseline. Class I change requests are in process to rebaseline the activities associated with KDs. An aggressive sampling schedule has been developed for the rotary and push mode sampling activity. Thirty-seven enforceable agreement milestones were schedule FYTD. Thirty-six (97 percent) of the thirty-seven were completed on or ahead of schedule and one (3 percent) is delinquent. The Department of Energy, Richland Operations Office entered into dispute resolution on April 7, 1995, for the delinquent milestone. Six (13 percent) of the 39 remaining enforceable agreement milestones scheduled for FY 1995 are forecast to be late. Additional information on these milestones can be found on pages 13 through 15. Performance data reflects a significant favorable $25.7 million (4 percent) cost variance. The majority of the cost variance is attributed to progress towards achievement of productivity commitment goals and is expected to continue for the remainder of this fiscal year.

20956 (WSRC-MS–95-0038) **The effect of chemical composition on the PCT durability of mixed waste glasses from wastewater treatment sludges.** Bickford, D.F. (Westinghouse Savannah River Co., Aiken, SC (United States)); Cicero, C.A.; Resce, J.L.; Ragsdale, R.G.; Overcamp, T.J. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950216–135: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95010967. Source: OSTI; NTIS; INIS; GPO Dep.

TTP/SR132004.

The Mixed Waste Integrated Program (NMIP) at the Department of Energy (DOE) has taken a serious look at vitrification for treatment of low-level mixed waste streams. This was prompted, in part, by the fact that the EPA has declared that vitrification is the Best Demonstrated Available Technology for the disposal of high-level radioactive waste. Among the low-level mixed waste streams within the DOE complex, which are under consideration for vitrification, are wastewater treatment sludges at the Savannah River Site (SRS), Oak Ridge Reservation (ORR), Rocky Flats Plant (RFP), and Los Alamos National Laboratory (LANL), These sludges typically contain low levels of radioactive and hazardous metals, water, and additives from the waste treatment process itself The treatment additives normally include precipitating and flocculating agents such as sodium, calcium, magnesium, and iron compounds or siliceous filter aids from the dewatering process. These treatment additives tend to be soluble in silicate glass and are thus amenable to vitrification.

20957 (WSRC-MS–95-0064) **Vitrification treatability studies of actual waste water treatment sludges.** Jantzen, C.M. (Westinghouse Savannah River Co., Aiken, SC (United States)); Hutson, N.D.; Gilliam, T.M.; Bleier, A.; Spence, R.D. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950216–134: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95010960. Source: OSTI; NTIS; INIS; GPO Dep.

Treatability studies have been conducted at the laboratory-scale to evaluate vitrification of waste water sludges at the Oak Ridge Reservation (ORR). These studies are being conducted jointly by Westinghouse Savannah River Technology Center (SRTC) and Oak Ridge National Laboratory (ORNL). These studies include testing with surrogate waste formulations at both the laboratory-scale and pilot-scale, and testing with actual waste at the laboratory-scale, pilot-scale, and field-scale. ORR was chosen as the host site for the field-scale demonstration. The Y12 West End Treatment Facility (WETF) waste water treatment sludges, which are RCRA F-listed wastes, were chosen as the candidate waste stream for the first field-scale demonstration. The laboratory-scale "proof-of-principle" demonstrations reported in this study and the pilot-scale studies planned for FY95 on the WETF sludge will provide needed operating parameters for the planned field-scale demonstration. These laboratory-scale "proof-of-principle" and pilot-scale studies also provide needed data for the evaluation of the feasibility of vitrification as a stabilization option for a variety of wastes which do not currently meet RCRA/LDR (Resource Conservation and Recovery Act/Land Disposal Restrictions) requirements for storage/disposal and/or those for which treatment capacity does not presently exist.

20958 (WSRC-MS–95-0138) **Design and Fabrication of a Transportable Vitrification System for Mixed Waste Processing.** Whitehouse, J.C. (Westinghouse Savannah River Company, Aiken, SC (United States)); Jantzen, C.M.; Van Ryn, F.R.; Davis, D.H. Westinghouse Savannah River Co., Aiken, SC (United States). 6 Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950877–11: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95060141. Source: OSTI; NTIS; INIS; GPO Dep.

The stabilization and disposal of mixed wastes, which contain both hazardous and radioactive materials, is a significant waste management challenge to the DOE complex.

20959 (WSRC-RP–94-1227-Rev.2) **Investigation-Derived Waste Management Plan. Revision 2.** Molen, G. Westinghouse Savannah River Co., Aiken, SC (United States). 24 May 1995. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060151. Source: OSTI; NTIS; INIS; GPO Dep.

SRS has implemented a comprehensive environmental program to maintain compliance with environmental regulations and mitigate impacts to the environment. One element of the environmental program is the investigation of inactive waste units. Environmental Investigation-Derived Waste (IDW). IDW may include purge water , soil cuttings, drilling fluids, well pumping test and development water, decontamination solutions, contaminated equipment, and personal protection equipment (PPE). In cases where investigations confirm the presence of contamination and the IDW contains waste constituents in concentrations high enough to be of environmental or health concern, special management procedures are warranted. This IDW Management Plan describes specific SRS initiatives for IDW management. The goal is the development of a plan for prudent management of IDW from environmental investigations that is protective of human health and the environment.

20960 (WSRC-TR–92-427-Rev.3) **Safety evaluation of the ITP filter/stripper test runs and quiet time runs using simulant solution. Revision 3.** Gupta, M.K. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1994. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95014725. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose is to provide the technical bases for the evaluation of Unreviewed Safety Question for the In-Tank Precipitation (ITP) Filter/Stripper Test Runs (Ref. 7) and Quiet Time Runs Program (described in Section 3.6). The Filter/Stripper Test Runs and Quiet Time Runs program involves a 12,000 gallon feed tank containing an agitator, a 4,000 gallon flush tank, a variable speed pump, associated piping and controls, and equipment within both the Filter and the Stripper Building.

20961 (WSRC-TR–93-451-Rev.2) **Pre-title I safety evaluation for the retrieval operations of transuranic waste drums in the Solid Waste Disposal Facility. Revision 2.** Rabin, M.S. Westinghouse Savannah River Co., Aiken, SC (United States). Aug 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95014722. Source: OSTI; NTIS; INIS; GPO Dep.

Phase I of the Transuranic (TRU) Waste Facility Line Item Project includes the retrieval and safe storage of the pad drums that are stored on TRU pads 2-6 in the Solid Waste Disposal Facility (SWDF). Drums containing TRU waste were placed on these pads as early as 1974. The pads, once filled, were mounded with soil. The retrieval activities will include the excavation of the soil, retrieval of the pad drums, placing the drums in overpacks (if necessary) and venting and purging the retrieved drums. Once the drums have been vented and purged, they will be transported to other pads within the SWDF or in a designated area until they are eventually treated as necessary for ultimate shipment to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. This safety evaluation provides a bounding assessment of the radiological risk involved with the drum retrieval activities to the maximally exposed offsite individual and the co-located worker. The results of the analysis indicate that the risk to the maximally exposed offsite individual and the co-located worker using maximum frequencies and maximum consequences are within the acceptance criteria defined in WSRC Procedural Manual 9Q. The purpose of this evaluation is to demonstrate the incremental risk from the SWDF due to the retrieval activities for use as design input only. As design information becomes available, this evaluation can be revised to satisfy the safety analysis requirements of DOE Orders 4700 and 5480.23.

20962 (WSRC-TR–93-508) **Structural analysis of closure cap barriers: A pre-test study for the Bentonite Mat Demonstration Project.** Gong, Chung. Westinghouse Savannah River Co., Aiken, SC (United States). Oct 1993. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95014724. Source: OSTI; NTIS; GPO Dep.

According to the EPA-recommended closure cap design a waste site can either be covered with a single layer cap made of 36

inches of compacted soil (clay) or with a multilayer cap consisting of an upper vegetative layer underlain by a drainage layer over a low permeability layer. The Bentonite Mat Demonstration Project (BMDP) is a field demonstration study to determine the construction/installation requirements, permeability, and subsidence performance characteristics of a composite barrier. The composite barrier will consist of on-site sandy-clay blanketed by a bentonite mat and a flexible High Density Polyethylene (HDPE) liner (also called flexible membrane liner). Construction of one control test pad and three bentonite test pads are planned. The control test pad will be used to establish baseline data. Underneath the composite clay cap is a four-foot loose sand layer in which cavities will be created by evacuation of sand. The present work provides a mathematical model for the BMDP. The mathematical model will be used to simulate the mechanical and structural responses of the composite clay cap during the testing processes. Based upon engineering experience and technical references, a set of nominal soil parameters have been selected. Currently, detailed soil test data and cavity configuration data are not available to validate the mathematical model. Since the configuration of the cavities created in the testing process is irregular and unpredictable, two extreme configurations are considered in this mathematical model, viz., the circular cavity and the infinitely long trench in the sand underneath the cap. This approach will provide bounds for the testing results.

20963 (WSRC-TR–94-0410) **Cylinder supplied ammonia scrubber testing in IDMS.** Lambert, D.P. Westinghouse Hanford Co., Richland, WA (United States). 31 Aug 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95010961. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of the off-line testing the Integrated DWPF Melter System (IDMS) ammonia scrubbers using ammonia supplied from cylinders. Three additional tests with ammonia are planned to verify the data collected during off-line testing. Operation of the ammonia scrubber during IDMS SRAT and SME processing will be completed during the next IDMS run. The Sludge Receipt and Adjustment Tank (SRAT) and Slurry Mix Evaporator (SME) scrubbers were successful in removing ammonia from the vapor stream to achieve ammonia vapor concentrations far below the 10 ppM vapor exit design basis. In most of the tests, the ammonia concentration in the vapor exit was lower than the detection limit of the analyzers so results are generally reported as <0.05 parts per million (ppM). During SRAT scrubber testing, the ammonia concentration was no higher than 2 ppM and during SME testing the ammonia concentration was no higher than 0.05 m.

20964 (WSRC-TR–94-0478) **Test Plan for Methanotrophic Bioreactor at Savannah River Site-TNX.** Berry, C.J. Westinghouse Savannah River Co., Aiken, SC (United States). 4 Oct 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060143. Source: OSTI; NTIS; INIS; GPO Dep.

The primary purpose of this project is to demonstrate the feasibility and practicality of operating a methanotrophic mobile trickle filter bioreactor (MMB) unit to effectively reduce or eliminate trichloroethylene (TCE) and associated hydrocarbons from contaminated groundwater. The two-column trickle filter system can process 1.67 gallons per minute (gpm) of contaminated groundwater. During this project, the pilot system will evaluate, optimize, and demonstrate methanotrophic treatment technology (MTT). The mobile system will receive a 1–4% methane to air mixture for stimulating the methanotrophic TCE degrading bacteria, thereby increasing the rates of degradation of these contaminants. This project will also evaluate the efficacy of different bacteria for degrading TCE for use in the system at the laboratory-scale sample groundwater monitoring wells at TNX and set up the system for continued operation. The trickle filter system may be used to inexpensively treat other small-scale organic waste streams at SRS after the initial start-up. The MTT was demonstrated as an effective and efficient method of degrading TCE in the laboratory and during a field-scale in situ demonstration for degrading TCE in a groundwater plume at SRS. The methanotrophic bacteria increase significantly in population numbers and in the production of methane monooxygenase (MMO), an extremely powerful oxidizer. MMO was demonstrated as effective in oxidizing TCE and other recalcitrant compounds in laboratory studies. In the presence of MMO, TCE is oxidized to TCE-epoxide, which breaks down spontaneously into simple, easily degraded, daughter compounds. The system will receive a 1–4% methane to air mixture, which will effectively grow and maintain the methanotrophic bacteria that will degrade TCE. This demonstration will have broad applications to bioremediating contaminated groundwater systems where in situ bioremediation is not practical.

20965 (WSRC-TR–94-0608-Ref.) **Proposed Site Treatment Plan (PSTP). STP reference document.** Westinghouse Savannah River Co., Aiken, SC (United States). 22 Feb 1995. 762p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95013475. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) is required by Section 3021(b) of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facility Compliance Act (FFCAct), to prepare a plan describing the development of treatment capacities and technologies for treating mixed waste (hazardous/radioactive waste). DOE decided to prepare its site treatment plan in a three phased approach. The first phase, called the Conceptual Site Treatment Plan (CSTP), was issued in October 1993. At the Savannah River Site (SRS) the CSTP described mixed waste streams generated at SRS and listed treatment scenarios for each waste stream utilizing an onsite, offsite DOE, and offsite or onsite commercial or vendor treatment option. The CSTP is followed by the Draft Site Treatment Plan (DSTP), due to be issued in August 1994. The DSTP, the current activity., will narrow the options discussed in the CSTP to a preferred treatment option, if possible, and will include waste streams proposed to be shipped to SRS from other DOE facilities as well as waste streams SRS may send offsite for treatment. The SRS DSTP process has been designed to address treatment options for each of the site's mixed waste streams. The SRS Proposed Site Treatment Plan (PSTP) is due to be issued in February 1995. The compliance order would be derived from the PSTP.

20966 (WSRC-TR–95-0025) **Survival of planted tupelo seedlings in F- and H-Area tree-kill zones.** Nelson, E.A.; Rogers, V.A. Westinghouse Savannah River Co., Aiken, SC (United States). Jan 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95010975. Source: OSTI; NTIS; INIS; GPO Dep.

Swamp tupelo seedlings were planted in four areas which experienced previous tree mortality at the seeplines of the F- and H-Area Seepage Basins. The sites represented a range in severity of impact and stage of recovery. Seedlings were planted in February of 1994 and followed through the first growing season in the field. Survival on all sites through the first growing season was excellent, with greater than 92% of the seedlings still alive. Most seedlings appeared healthy with few external signs of stress. The performance of the seedlings will be followed in subsequent years to determine the physical state of the soil environment on seedling growth. Hopefully, the results will indicate that artificial reforestation can begin on similarly impacted sites prior to the beginning of natural revegetation of the site.

20967 (WSRC-TR–95-0029) **Magnetic Survey of K-Area Bingham Pump Outage Pit.** Cumbest, R.J. Westinghouse Savannah River Co., Aiken, SC (United States). 19 Jan 1995. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060135. Source: OSTI; NTIS; INIS; GPO Dep.

A magnetic survey was conducted at the K-Area Bingham Pump Outage Pit to locate buried metallic construction material placed in the pit. The survey was defined by survey lines spaced 10 feet apart and oriented subperpendicular to the pit elongation direction with survey stations spaced at 5-foot intervals along each line. This arrangement resulted in a 10-foot by 5-foot rectangular grid node pattern. The magnetic survey resolved a linear array of magnetic field and gradient anomalies that result from ferric material buried in the pit. The magnetic survey also resolved other isolated anomalies from ferric sources such as signs and monuments located on the surface. Comparison of the magnetic survey data with

radar transects collected in a previous survey indicates that the magnetic anomalies, in most cases, correlate well with diffractions in the radar data. At locations where the anomalies and diffractions do not correlate well, it appears that the radar transect did not pass directly over the anomaly source, resulting in off-line, three-dimensional (3-D) effects in the radar data. Based on the comparison of the two methods, the magnetic data resolves the part of the trench containing the ferrous material; however, the radar data are sensitive to disturbed soil and can resolve the trench boundaries in the absence of buried metallic material.

20968 (WSRC-TR–95-0160) **Decontaminating and Melt Recycling Tritium Contaminated Stainless Steel.** Clark, E.A. Westinghouse Savannah River Co., Aiken, SC (United States). 3 Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060140. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Savannah River Company, Idaho National Engineering Laboratory, and several university and industrial partners are evaluating recycling radioactively contaminated stainless steel. The goal of this program is to recycle contaminated stainless steel scrap from US Department of Energy national defense facilities. There is a large quantity of stainless steel at the DOE Savannah River Site from retired heavy water moderated Nuclear material production reactors (for example heat exchangers and process water piping), that will be used in pilot studies of potential recycle processes. These parts are contaminated by fission products, activated species, and tritium generated by neutron irradiation of the primary reactor coolant, which is heavy (deuterated) water. This report reviews current understanding of tritium contamination of stainless steel and previous studies of decontaminating tritium exposed stainless steel. It also outlines stainless steel refining methods, and proposes recommendations based on this review.

20969 (WSRC-TR–95-0176) **Electronic Denitration Savannah River Site Radioactive Waste.** Hobbs, D.T. Westinghouse Savannah River Co., Aiken, SC (United States). 11 Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060149. Source: OSTI; NTIS; INIS; GPO Dep.

Electrochemical destruction of nitrate in radioactive Savannah River Site Waste has been demonstrated in a bench-scale flow cell reactor. Greater than 99% of the nitrate can be destroyed in either an undivided or a divided cell reactor. The rate of destruction and the overall power consumption is dependent on the cell configuration and electrode materials. The fastest rate was observed using an undivided cell equipped with a nickel cathode and nickel anode. The use of platinized titanium anode increased the energy requirement and costs compared to a nickel anode in both the undivided and divided cell configurations.

20970 (WSRC-TR–95-0178) **Limits on Annulus Air Outages in Types 1, 2, and 3 Waste Tanks.** Wiersma, B.J.; Sindelar, R. L. Westinghouse Savannah River Co., Aiken, SC (United States). 12 Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060142. Source: OSTI; NTIS; INIS; GPO Dep.

An evaluation was performed on the impact of abnormal air flow conditions on the structural integrity of Types 1, 2, and 3 waste tanks. Warm, dry air in the annular space is necessary to preclude low temperature embrittlement and corrosive conditions for the carbon steel materials. For Type 1 and 2 tanks the annulus air system should be repaired within a month to minimize the potential for low temperature embrittlement and corrosive conditions, for Tanks 29-34, which are Type 3 tanks, it is recommended that the system be repaired within two months to minimize the potential for low temperature embrittlement. For all other Type 3 tanks repair of the system within six months is adequate to minimize general corrosion.

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Refer also to citation(s) 20739, 20777, 20778, 20782, 20789, 20790, 20807, 20831, 20832, 20838, 20840, 20848, 20933, 20959, 20966, 20996, 21003, 21004, 21006, 21012, 21013, 21019, 21029, 21353, 21549, 21550, 22270, 22276, 22334, 22336, 22337, 22338, 22339, 22351

20971 (DOE–95012345) **Environmental surveillance results for 1994 for the Hazelwood Interim Storage Site. FUSRAP technical memorandum Number 140-95-011.** Szojka, S. USDOE, Washington, DC (United States). 1 Jun 1995. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012345. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents analytical results and an interpretation of the results for samples collected as part of the 1994 environmental surveillance program for the Hazelwood Interim Storage Site (HISS) for the interim storage of radiologically contaminated soils. The discussion provides a comparative analysis of local background conditions and applicable regulatory criteria to results reported for external gamma radiation and for samples from the media investigated (air, surface water, sediment, groundwater, and stormwater). Results from the 1994 environmental surveillance program at HISS indicate that Department of Energy (DOE) guidelines were not exceeded for the calculated airborne particulate dose or for the monitored constituents.

20972 (DOE/EA–0808) **Future management of hazardous wastes generated at Brookhaven National Laboratory, Upton, New York. Environmental assessment.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Sep 1994. 47p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012127. Source: OSTI; NTIS; INIS; GPO Dep.

This document assesses the potential environmental impacts of a variety of alternatives which could provide a Resource Conservation and Recovery Act (RCRA) permitted waste packaging and storage facility that would handle all hazardous, radioactive, and mixed wastes generated at Brookhaven National Laboratory (BNL) and would operate in full compliance with all federal, state, and local laws and regulations. Location of the existing Hazardous Waste Management Facility (HWMF) with respect to ground water and the site boundary, technical and capacity limitations, inadequate utilities, and required remediation of the area make the existing facility environmentally unacceptable for long term continued use. This Environmental Assessment (EA) describes the need for action by the Department of Energy (DOE). It evaluates the alternatives for fulfilling that need, including the alternative preferred by DOE, a no-action alternative, and other reasonable alternatives. The EA provides a general description of BNL and the existing environment at the current HWMF and alternative locations considered for a new Waste Management Facility (WMF). Finally, the EA describes the potential environmental impacts of the alternatives considered. The preferred alternative, also identified as Alternative D, would be to construct and operate a new WMF on land formerly occupied by barracks during Camp Upton operations, in an area north of Building 830 and the High Flux Beam Reactor/Alternating Gradient Synchrotron (AGS) recharge basins, east of North Railroad Street, and south of East Fifth Avenue. The purpose of this new facility would be to move all storage and transfer activities inside buildings and on paved and curbed areas, consolidate facilities to improve operations management, and provide improved protection of the environment.

20973 (DOE/EA–0937) **Environmental assessment for the construction and operation of waste storage facilities at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of NEPA Oversight. Jun 1994. 147p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012965. Source: OSTI; NTIS; INIS; GPO Dep.

DOE is proposing to construct and operate 3 waste storage facilities (one 42,000 ft^2 waste storage facility for RCRA waste, one 42,000 ft^2 waste storage facility for toxic waste (TSCA), and one 200,000 ft^2 mixed (hazardous/radioactive) waste storage facility) at Paducah. This environmental assessment compares impacts of this proposed action with those of continuing present practices aof of using alternative locations. It is found that the construction, operation, and ultimate closure of the proposed waste storage facilities would not significantly affect the quality of the human environment

within the meaning of NEPA; therefore an environmental impact statement is not required.

20974 (DOE/EA–1000) **Proposed low-level radioactive waste handling building at Fermi National Accelerator Laboratory, Batavia, Illinois.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). [1995]. 48p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012248. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) has prepared an Environmental Assessment (EA), evaluating the impacts associated with the proposed Low-Level Radioactive Waste Building at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. As a result of the high energy physics program at Fermilab, small quantities of low-level radioactive wastes are generated. These wastes are collected, sorted and packaged for shipment to an off-site disposal facility in Hanford, Washington. The proposed project includes the construction of a new building to house, all low-level radioactive waste handling operations. The building would provide workspace for five full-time workers. The proposed project would improve the efficiency and safety of the low-level radioactive waste handling at Fermilab by upgrading equipment and consolidating operations into one facility.

20975 (DOE/EA–1005-Vol.1) **Disposition and transportation of surplus radioactive low specific activity nitric acid. Volume 1, Environmental Assessment.** USDOE Richland Operations Office, WA (United States). May 1995. 95p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012966. Source: OSTI; NTIS; INIS; GPO Dep.

DOE is deactivating the PUREX plant at Hanford; this will involve the disposition of about 692,000 liters (183,000 gallons) of surplus nitric acid contaminated with low levels of U and other radionuclides. The nitric acid, designated as low specific activity, is stored in 4 storage tanks at PUREX. Five principal alternatives were evaluated: transfer for reuse (sale to BNF plc), no action, continued storage in Hanford upgraded or new facility, consolidation of DOE surplus acid, and processing the LSA nitric acid as waste. The transfer to BNF plc is the preferred alternative. From the analysis, it is concluded that the proposed disposition and transportation of the acid does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of NEPA; therefore an environmental impact statement is not required.

20976 (DOE/EA–1005-Vol.2) **Disposition and transportation of surplus radioactive low specific activity nitric acid. Volume 2, Environmental Assessment.** USDOE Richland Operations Office, WA (United States). May 1995. 235p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012967. Source: OSTI; NTIS; INIS; GPO Dep.

This volume consists of two appendices: public comments and DOE responses, and public comments not requiring responses.

20977 (DOE/EA–1063) **Disposition of highly enriched uranium obtained from the Republic of Kazakhstan. Environmental assessment.** USDOE Office of Fissile Materials Disposition, Washington, DC (United States). May 1995. 86p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013323. Source: OSTI; NTIS; INIS; GPO Dep.

This EA assesses the potential environmental impacts associated with DOE's proposal to transport 600 kg of Kazakhstand-origin HEU from Y-12 to a blending site (B&W Lynchburg or NFS Erwin), transport low-enriched UF6 blending stock from a gaseous diffusion plant to GE Wilmington and U oxide blending stock to the blending site, blending the HEU and uranium oxide blending stock to produce LEU in the form of uranyl nitrate, and transport the uranyl nitrate from the blending site to USEC Portsmouth.

20978 (DOE/EA–1065) **Environmental assessment for the proposed construction and operation of a Genome Sequencing Facility in Building 64 at Lawrence Berkeley Laboratory, Berkeley, California.** USDOE, Washington, DC (United States). Apr 1995. 34p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012234. Source: OSTI; NTIS; INIS; GPO Dep.

This document is an Environmental Assessment (EA) for a proposed project to modify 14,900 square feet of an existing building (Building 64) at Lawrence Berkeley Laboratory (LBL) to operate as a Genome Sequencing Facility. This EA addresses the potential environmental impacts from the proposed modifications to Building 64 and operation of the Genome Sequencing Facility. The proposed action is to modify Building 64 to provide space and equipment allowing LBL to demonstrate that the Directed DNA Sequencing Strategy can be scaled up from the current level of 750,000 base pairs per year to a facility that produces over 6,000,000 base pairs per year, while still retaining its efficiency.

20979 (ES/ESH–48) **Environmental monitoring and surveillance on the Oak Ridge Reservation: 1993 Data.** Koncinski, W.S. (ed.) (Oak Ridge National Lab., TN (United States)). Oak Ridge Y-12 Plant, TN (United States); Oak Ridge National Lab., TN (United States); Oak Ridge K-25 Site, TN (United States). Dec 1994. 492p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013227. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring and surveillance are conducted on the Oak Ridge Reservation and its environs throughout the year. Environmental monitoring ensures that (1) the reservation is a safe place to work, (2) activities on the reservation do not adversely affect the neighboring communities, and (3) compliance is made with federal and state regulations. This document is a compilation of the monitoring and surveillance data for calendar year 1993. It is a tool for analysts in the fields of environmental monitoring and environmental restoration. The summary information found in the annual site environmental report was drawn from the contents of summary in this document.

20980 (K/GDP/SAR–65) **Application of the HGSYSTEM/UF_6 model to simulate atmospheric dispersion of UF_6 releases from uranium enrichment plants.** Goode, W.D. Jr.; Bloom, S.G.; Keith, K.D. Jr. Oak Ridge K-25 Site, TN (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-950927–1: International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials, New Orleans, LA (United States), 26-29 Sep 1995). Order Number DE95007708. Source: OSTI; NTIS; INIS; GPO Dep.

Uranium hexafluoride is a dense, reactive gas used in Gaseous Diffusion Plants (GDPs) to make uranium enriched in the ^{235}U isotope. Large quantities of UF_6 exist at the GDPs in the form of in-process gas and as a solid in storage cylinders; smaller amounts exist as hot liquid during transfer operations. If liquid UF_6 is released to the environment, it immediately flashes to a solid and a dense gas that reacts rapidly with water vapor in the air to form solid particles of uranyl fluoride and hydrogen fluoride gas. Preliminary analyses were done on various accidental release scenarios to determine which scenarios must be considered in the safety analyses for the GDPS. These scenarios included gas releases due to failure of process equipment and liquid/gas releases resulting from a breach of transfer piping from a cylinder. A major goal of the calculations was to estimate the response time for mitigating actions in order to limit potential off-site consequences of these postulated releases. The HGSYSTEM/UF_6 code was used to assess the consequences of these release scenarios. Inputs were developed from release calculations which included two-phase, choked flow followed by expansion to atmospheric pressure. Adjustments were made to account for variable release rates and multiple release points. Superpositioning of outputs and adjustments for exposure time were required to evaluate consequences based on health effects due to exposures to uranium and HF at a specific location.

20981 (LA–12573-MS) **Distribution of potentially hazardous phases in the subsurface at Yucca Mountain, Nevada.** Guthrie, G.D. Jr.; Bish, D.L.; Chipera, S.J.; Raymond, R. Jr. Los Alamos National Lab., NM (United States). May 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011012. Source: OSTI; NTIS; INIS; GPO Dep.

Drilling, trenching, excavation of the Exploratory Studies Facility, and other surface and underground-distributing activities have the potential to release minerals into the environment from tuffs at

Yucca Mountain, Nevada. Some of these minerals may be potential respiratory health hazards. Therefore, an understanding of the distribution of the minerals that may potentially be liberated during site-characterization and operation of the potential repository is crucial to ensuring worker and public safety. Analysis of previously reported mineralogy of Yucca Mountain tuffs using data and criteria from the International Agency for Research on Cancer (IARC) suggests that the following minerals are of potential concern: quartz, cristobalite, tridymite, opal-CT, erionite, mordenite, and palygorskite. The authors have re-evaluated the three-dimensional mineral distribution at Yucca Mountain above the static water level both in bulk-rock samples and in fractures, using quantitative X-ray powder diffraction analysis. Erionite, mordenite, and palygorskite occur primarily in fractures; the crystalline-silica minerals, quartz, cristobalite, and tridymite are major bulk-rock phases. Erionite occurs in the altered zone just above the lower Topopah Spring Member vitrophyre, and an occurrence below the vitrophyre but above the Calico Hills has recently been identified. In this latter occurrence, erionite is present in the matrix at levels up to 35 wt%. Mordenite and palygorskite occur throughout the vadose zone nearly to the surface. Opal-CT is limited to zeolitic horizons.

20982 (UCRL-ID–119101) **A progress report for the large block test of the coupled thermal-mechanical-hydrological-chemical processes.** Lin, W. (and others); Wilder, D.G.; Blink, J. Lawrence Livermore National Lab., CA (United States). Oct 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011432. Source: OSTI; NTIS; INIS; GPO Dep.

This is a progress report on the Large Block Test (LBT) project. The purpose of the LBT is to study some of the coupled thermal-mechanical-hydrological-chemical (TMHC) processes in the near field of a nuclear waste repository under controlled boundary conditions. To do so, a large block of Topopah Spring tuff will be heated from within for about 4 to 6 months, then cooled down for about the same duration. Instruments to measure temperature, moisture content, stress, displacement, and chemical changes will be installed in three directions in the block. Meanwhile, laboratory tests will be conducted on small blocks to investigate individual thermal-mechanical, thermal-hydrological, and thermal-chemical processes. The fractures in the large block will be characterized from five exposed surfaces. The minerals on fracture surfaces will be studied before and after the test. The results from the LBT will be useful for testing and building confidence in models that will be used to predict TMHC processes in a repository. The boundary conditions to be controlled on the block include zero moisture flux and zero heat flux on the sides, constant temperature on the top, and constant stress on the outside surfaces of the block. To control these boundary conditions, a load-retaining frame is required. A 3 x 3 x 4.5 m block of Topopah Spring tuff has been isolated on the outcrop at Fran Ridge, Nevada Test Site. Pre-test model calculations indicate that a permeability of at least 10^{-15} m^2 is required so that a dryout zone can be created within a practical time frame when the block is heated from within. Neutron logging was conducted in some of the vertical holes to estimate the initial moisture content of the block. It was found that about 60 to 80% of the pore volume of the block is saturated with water. Cores from the vertical holes have been used to map the fractures and to determine the properties of the rock. A current schedule is included in the report.

20983 (UCRL-JC–119798) **Criteria for calculating the efficiency of deep-pleated HEPA filters with aluminum separators during and after design basis accidents.** Bergman, W. (Lawrence Livermore National Lab., CA (United States)); First, M.W.; Anderson, W.L.; Gilbert, H.; Jacox, J.W. Lawrence Livermore National Lab., CA (United States). Feb 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940738–12: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE95011438. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have reviewed the literature on the performance of high efficiency particulate air (HEPA) filters under normal and abnormal conditions to establish criteria for calculating the efficiency of HEPA filters in a DOE nonreactor nuclear facility during and after a Design Basis Accident (DBA). This study is only applicable to the standard deep-pleated HEPA filter with aluminum separators as specified in ASME N509. The literature review included the performance of new filters and parameters that may cause deterioration in the filter performance such as filter age, radiation, corrosive chemicals, seismic and rough handling, high temperature, moisture, particle clogging, high air flow and pressure pulses. The deterioration of the filter efficiency depends on the exposure parameters; in severe exposure conditions the filter will be structurally damaged and have a residual efficiency of 0%. Despite the many studies on HEPA filter performance under adverse conditions, there are large gaps and limitations in the data that introduce significant error in the estimates of HEPA filter efficiencies under DBA conditions. Because of this limitation, conservative values of filter efficiency were chosen when there was insufficient data.

20984 (WHC-EP–0466-2) **Facility effluent monitoring plan for 242-A evaporator facility.** Crummel, G.M.; Gustavson, R.D. Westinghouse Hanford Co., Richland, WA (United States). Feb 1995. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95008793. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could affect employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation showed the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-1. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated, as a minimum, every three years.

20985 (WHC-EP–0536-2) **Quality assurance program plan for radionuclide airborne emissions monitoring.** Boom, R.J. Westinghouse Hanford Co., Richland, WA (United States). Mar 1995. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010579. Source: OSTI; NTIS; INIS; GPO Dep.

This Quality Assurance Program Plan identifies quality assurance program requirements and addresses the various Westinghouse Hanford Company organizations and their particular responsibilities in regards to sample and data handling of airborne emissions. The Hanford Site radioactive airborne emissions requirements are defined in National Emissions Standards for Hazardous Air Pollutants (NESHAP), Code of Federal Regulations, Title 40, Part 61, Subpart H (EPA 1991a). Reporting of the emissions to the US Department of Energy is performed in compliance with requirements of US Department of Energy, Richland Operations Office Order 5400.1, General Environmental Protection Program (DOE-RL 1988). This Quality Assurance Program Plan is prepared in accordance with and to the requirements of QAMS-004/80, Guidelines and Specifications for Preparing Quality Assurance Program Plans (EPA 1983). Title 40 CFR Part 61, Appendix B, Method 114, Quality Assurance Methods (EPA 1991b) specifies the quality assurance requirements and that a program plan should be prepared to meet the requirements of this regulation. This Quality Assurance Program Plan identifies NESHAP responsibilities and how the Westinghouse Hanford Company Environmental, Safety, Health, and Quality Assurance Division will verify that the methods are properly implemented.

20986 (WHC-SD-EN-CSUD–002) **ABCASH plotting program users guide.** Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). 25 Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011652. Source: OSTI; NTIS; INIS; GPO Dep.

The Automated Bar Coding of Air Samples at Hanford (ABCASH) system provides an integrated data collection, sample tracking, and data reporting system for radioactive particulate air filter samples. The ABCASH plotting program provides a graphical trend report for ABCASH of the performance of air sample results. This document provides an operational guide for using the program. Based on sample location identifier and date range, a trend chart of the available data is generated. The trend chart shows radiological activity versus time. General indications of directional trend of the concentrations in air over time may be discerned. Comparison limit set point values are also shown as derived from the ABCASH data base.

20987 (WHC-SD-GN-TI–20004) **A method for estimating ground areas contaminated by a postulated fire in a facility containing radioactive material.** Himes, D.A. Westinghouse Hanford Co., Richland, WA (United States). 31 Aug 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010677. Source: OSTI; NTIS; INIS; GPO Dep.

A simple method has been developed for estimating the extent of radiological ground contamination associated with postulated fires in nuclear facilities to be used as input to the estimation of replacement and cleanup cost. The basic model assumes that the radioactive material is released in the form of particles in a wide range of sizes (0 to about 300 μm) and is carried aloft in the thermal plume from the fire. The particles are then assumed to be released where the thermal plume reaches equilibrium height, and to fall to the ground at a continuous range of speeds associated with the various particle sizes. The thermal output of the fire and resulting equilibrium plume height are determined using standard models. The downward movement and dispersion of the particles is modelled using a tilted Gaussian plume. This approach produces a realistic distribution of particulate material on the ground with the larger particles fatting close to the fire and smaller particles being carried further out and dispersed over a Larger area. The model includes simple methods to determine maximum allowable inventory or fire size so as not to exceed a limiting cleanup area (or cost), thus permitting direct calculation of the maximum sizes of inventory modules to be separated by fire barriers.

20988 (WHC-SP–0665-16) **Quarterly environmental radiological survey summary: First quarter 1995 100, 200, 300, and 600 Areas.** McKinney, S.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011571. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a summary of the radiological surveys performed in support of the operational environmental monitoring program at the Hanford Site. The surveys included in this program consist of inactive waste sites; outdoor radiological control areas; tank farm perimeters and associated diversion boxes, lift stations, and vent stations; perimeters of active or uncovered waste sites such as burial grounds, retention basins, ponds, process trenches, and ditches; and road and rail surfaces. This report provides a summary of the radiological surveys performed during the First Quarter of 1995. The status of corrective actions required from current and past reports are also discussed.

20989 (WSRC-TR–91-671-Rev.1) **An atmospheric tritium release database for model comparisons. Revision 1.** Murphy, C.E. Jr.; Wortham, G.R. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95010962. Source: OSTI; NTIS; INIS; GPO Dep.

A database of vegetation, soil, and air tritium concentrations at gridded coordinate locations following nine accidental atmospheric releases is described. While none of the releases caused a significant dose to the public, the data collected are valuable for comparison with the results of tritium transport models used for risk assessment. The largest, potential, individual off-site dose from any of the releases was calculated to be 1.6 mrem. The population dose from this same release was 46 person-rem which represents 0.04% of the natural background radiation dose to the population in the path of the release.

20990 (WSRC-TR–94-0492) **K-Area Acid/Caustic Basin groundwater monitoring report. Third quarter 1994.** Westinghouse Savannah River Co., Aiken, SC (United States). Dec 1994. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95010976. Source: OSTI; NTIS; INIS; GPO Dep.

During third quarter 1994, samples from the KAC monitoring wells at the K-Area Acid/Caustic Basin were collected and analyzed for herbicides/pesticides, indicator parameters, metals, nitrate, radionuclide indicators, and other constituents. Monitoring results that exceeded the final Primary Drinking Water Standards (PDWS), other Savannah River Site (SRS) Flag 2 criteria, or the SRS turbidity standard are provided in this report. No constituents exceeded the final PDWS in the KAC wells. Aluminum and iron exceeded other SRS flagging criteria in one or more of the downgradient wells. Groundwater flow direction and rate in the water table beneath the K-Area Acid/Caustic Basin were similar to past quarters.

20991 (WSRC-TR–94-0545) **D&D Characterization of the 232-F Old Tritium Facility at the Savannah River Site.** Scallon, K.L.; England, J.L. Westinghouse Savannah River Co., Aiken, SC (United States). 17 Jan 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950877–10: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95060130. Source: OSTI; NTIS; INIS; GPO Dep.

The 232-F "Old Tritium Facility" operated in the 1950s as the first tritium production facility at the Savannah River Site (SRS). In 1957, the 232-F operation ceased with tritium production turned over to a larger, technologically improved facility at SRS. The 232-F Facility was abandoned in 1958 and the process areas have remained contaminated with radiological, hazardous and mixed constituents. Decontamination and decommissioning (D&D) of the 232-F Facility is scheduled to occur in the years 1995-1996. This paper presents the D&D characterization efforts for the 232-F Facility.

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Refer also to citation(s) 20736, 20739, 20745, 20755, 20756, 20765, 20766, 20775, 20776, 20792, 20809, 20814, 20841, 20845, 20847, 20848, 20849, 20853, 20860, 20861, 20863, 20865, 20873, 20883, 20886, 20893, 20936, 20939, 20941, 20961, 20965, 20974, 20981, 20991, 21396, 21760, 21761, 21762, 21763, 22323, 22335, 22340, 22400, 22457

20992 (ANL/EAD/TM–42) **Derivation of guidelines for uranium residual radioactive material in soil at the former Baker Brothers, Inc., Site, Toledo, Ohio.** Nimmagadda, M.; Kamboj, S.; Yu, C. Argonne National Lab., IL (United States). Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012410. Source: OSTI; NTIS; INIS; GPO Dep.

Residual radioactive material guidelines for uranium in soil were derived for the former Baker Brothers, Inc., site in Toledo, Ohio. This site has been identified for remedial action under the U.S. Department of Energy's (DOE's) Formerly Utilized Sites Remedial Action Program (FUSRAP). Single-nuclide and total-uranium guidelines were derived on the basis of the requirement that following remedial action, the 50-year committed effective dose equivalent to a hypothetical individual living or working in the immediate vicinity of the site should not exceed a dose constraint of 30 mrem/yr for the current use and likely future use scenarios or a dose limit of 100 mrem/yr for less likely future use scenarios. The DOE residual radioactive material guideline computer code, RESRAD, was used in this evaluation; RESRAD implements the methodology described in the DOE manual for establishing residual radioactive material guidelines. Three scenarios were considered; each assumed that for a period of 1,000 years following remedial action, the site would be used without radiological restrictions. The three scenarios varied with regard to the type of site use, time spent at the site by the exposed individual, and sources of food and water consumed. The evaluation indicates that the dose constraint of 30 mrem/yr would not be exceeded for uranium (including uranium-234, uranium-235,

and uranium-238) within 1,000 years, provided that the soil concentration of total combined uranium (uranium-234, uranium-235, and uranium-238) at the former Baker Brothers site did not exceed 710 pCi/g for Scenario A (industrial worker, current use) or 210 pCi/g for Scenario B (resident - municipal water supply, a likely future use). The dose limit of 100 mrem/yr would not be exceeded at the site if the total uranium concentration of the soil did not exceed 500 pCi/g for Scenario C (subsistence farmer - on-site well water, a plausible but unlikely future use).

20993 (ANL/EAIS/PP–78512) **An object-oriented approach to site characterization decision support.** Johnson, R. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95012210. Source: OSTI; NTIS; INIS; GPO Dep.

Effective decision support for site characterization is key to determining the nature and extent of contamination and the associated human and environmental risks. Site characterization data, however, present particular problems to technical analysts and decision-makers. Such data are four dimensional, incorporating temporal and spatial components. Their sheer volume can be daunting – sites with hundreds of monitoring wells and thousands of samples sent for laboratory analyses are not uncommon. Data are derived from a variety of sources including laboratory analyses, non-intrusive geophysical surveys, historical information, bore logs, in-field estimates of key physical parameters such as aquifer transmissivity, soil moisture content, depth-to-water table, etc. Ultimately, decisions have to be made based on data that are always incomplete, often confusing, inaccurate, or inappropriate, and occasionally wrong. In response to this challenge, two approaches to environmental decision support have arisen, Data Quality Objectives (DQOS) and the Observational Approach (OA). DQOs establish criteria for data collection by clearly defining the decisions that need to be made, the uncertainty that can be tolerated, and the type and amount of data that needs to be collected to satisfy the uncertainty requirements. In practice, DQOs are typically based on statistical measures. The OA accepts the fact that the process of characterizing and remediating contaminated sites is always uncertain. Decision-making with the OA is based on what is known about a site, with contingencies developed for potential future deviations from the original assumptions about contamination nature, extent, and risks posed.

20994 (ANL/EMO/CP–86349) **Action-oriented characterization at Argonne National Laboratory.** Moos, L.P.; Swale, R.E. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505101–3: Conference on challenges and innovations in the management of hazardous waste, Washington, DC (United States), 10-12 May 1995). Order Number DE95013444. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory-East and the US Department of Energy have initiated a voluntary corrective action strategy to characterize and clean up some of the on-site solid waste management units that are subject to the Resource Conservation and Recovery Act Corrective Action process. This strategy is designed for the current atmosphere of reduced funding levels and, increased demands for cleanup actions. A focused characterization program is used to identify and roughly delineate the areas of greatest risk, relying as much as possible on existing data about the site; then, removal or interim remedial actions are implemented, where appropriate. Two interim cleanup operations were completed in 1994. Two additional interim actions are planned for 1995. Future actions may include decontamination operations, soil remediation, and construction of containment barriers.

20995 (ANL/ES/PP–80277) **Development of an ultrasonic process for soil remediation.** Wu, J.M.; Huang, H.S.; Livengood, C.D. Argonne National Lab., IL (United States). [1995]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95012208. Source: OSTI; NTIS; INIS; GPO Dep.

An ultrasonic process for the detoxification of carbon tetrachloride- (CCl_4^-) contaminated soil was investigated in the laboratory by using a batch irradiation reactor equipped with a 600-W ultrasonic power supply operated at a frequency of 20 kHz. Key parameters studied included soil characteristics, irradiation time, CCl_4 concentration, steady-state operating temperature, applied ultrasonic-wave energy, and the ratio of soil to water in the system. The results of the experiments showed that (1) residual CCl_4 concentrations could be decreased with longer irradiation periods and (2) detoxification efficiency was proportional to steady-state operating temperature and applied ultrasonic-wave energy. The characteristics of the contaminated soil were found to be an important factor in the design of an ultrasonic detoxification system. A soil-phase CCl_4 concentration below 1 ppm (initial concentration of 56 ppm) was achieved through this process, indicating that the application of ultrasonic irradiation is feasible and effective in the detoxification of soil contaminated by organic compounds. On the basis of the experimental results, a schematic of a full-scale ultrasonic soil-detoxification system was developed. Improvements to this novel process are discussed.

20996 (CONF-950216–139) **Trade-offs between worker risk and public risk during remediation at DOE sites.** Beam, B.N.; Morris, J.; Blaylock, B.; Travis, C. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '95; Tucson, AZ (United States); 26 Feb - 2 mar 1995. Order Number DE95012881. Source: OSTI; NTIS; INIS; GPO Dep.

Within the next 30 years, the US Department of Energy (DOE) Environmental Restoration Program will be responsible for remediating thousands of waste sites across the DOE complex. A major concern during remediation will be the protection of thousands of workers engaged in the remediation. In addition to well know safety hazards associated with conventional construction operations, remedial workers at DOE will encounter radiation and chemical exposures from radioactive, hazardous, and mixed waste. Although historically represented as minimal due to a paucity of data related to worker exposures during remediation, potential worker health risk is an important factor that must be taken into account in the selection of remedial strategies, and the potential risk reduction offered by a remedial strategy must be weighed against the potential worker risk incurred during its implementation. Analysis has shown a trend that the worker risk incurred outweighs,the benefits of risk reduction to the public.

20997 (CONF-950570–23) **Radon concentration and working level in the Exploratory Studies Facility (ESF).** Stiver, J.H.; Tung, Chao-Hsiung. Science Applications International Corp., Las Vegas, NV (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. From International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995. Order Number DE95012996. Source: OSTI; NTIS; INIS; GPO Dep.

Radon-222 (^{222}Rn) and ^{222}Rn progeny WL monitoring in the Exploratory Studies Facility (ESF) was initiated to support regulatory compliance. Measurements were taken over two periods, in Test Alcove No. 1 of the ESF, about 60 m from the tunnel entrance. For both periods, ^{222}Rn concentration was less than 10% of the Derived Air Concentration (DAC) set forth in DOE Order 5480.11. Thus, these assessments were sufficient to demonstrate regulatory compliance. Based on these findings, quarterly ^{222}Rn and ^{222}Rn progeny monitoring was initiated. Two systems each were employed for ^{222}Rn and ^{222}Rn progeny measurement. No significant differences were observed between the respective systems. An interesting finding was that at the time the measurements were taken, barometric pressure appeared to be the predominant factor controlling ^{222}Rn concentration in the ESF. This was true even during periods of ventilation shutdown.

20998 (DOE/AL/62350–177) **Ground water work breakdown structure dictionary.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95011234. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the activities that are necessary to assess in ground water remediation as specified in the UMTRA Project.

These activities include the following: site characterization; remedial action compliance and design documentation; environment, health, and safety program; technology assessment; property access and acquisition activities; site remedial actions; long term surveillance and licensing; and technical and management support.

20999 (DOE/AL/62350–183) **Final audit report of remedial action construction at the UMTRA Project, Grand Junction, Colorado, processing site.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95011231. Source: OSTI; NTIS; INIS; GPO Dep.

This final audit report (FAR) for remedial action at the Grand Junction, Colorado, Uranium Mill Tailings Remedial Action (UMTRA) Project processing site consists of a summary of the radiological surveillances/audits, the quality assurance (QA) in-process surveillances, and the QA final close-out inspection performed by the US Department of Energy (DOE) and Technical Assistance Contractor (TAC). The FAR also summarizes other surveillances performed by the US Nuclear Regulatory Commission (NRC). To summarize, a total of one finding and 127 observations were noted during DOE/TAC audit and surveillance activities. The NRC noted general site-related observations during the OSCRs. Follow-up to responses required from MK-Ferguson for the DOE/TAC finding and observations indicated that all issues related to the Grand Junction processing site were resolved and closed out to the DOE's satisfaction. The NRC OSCRs resulted in no issues related to the Grand Junction processing site requiring a response from MK-Ferguson.

21000 (DOE/AL/62350–190) **Private well/spring position paper, Rifle, Colorado, sites.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). May 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95011233. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the hydrogeochemical relationship between the New and Old Rifle processing sites and 15 domestic wells in their vicinity. The relationship of the domestic wells to the Old and New Rifle tailings sites requires clarification due to recent advances in understanding of Rifle site conceptual models. In order to form a bridge from the Rifle remedial action plan (RAP) and the recent baseline risk assessment to this position paper, several issues require discussion. First, through analysis of long-term ground water level data, the hydraulic gradient between the former tailings and private wells and springs was assessed. Second, in the Rifle RAP there was not a strong emphasis placed on describing regional influences on water quality in the vicinity of the processing sites. This document uses available information coupled with theory of regional ground water flow to describe regional flow systems north of Rifle. Third, the definition of background water quality from the RAP has been refined in several ways. Also, for the recent baseline risk assessment, all alluvial wells used to define background for the sites were located east of Old Rifle. In the RAP, alluvial background wells were also placed between the sites (downgradient of Old Rifle). Two additional wells were installed for the recent baseline risk assessment upgradient of Old Rifle which verified that several of the older wells (RFO-01-0597 and -0598) were in locations representative of background.

21001 (DOE/AL/62350–192) **Ground water elevation monitoring at the Uranium Mill Tailings Remedial Action Salt Lake City, Utah, Vitro processing site.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95011232. Source: OSTI; NTIS; INIS; GPO Dep.

In February 1994, a ground water level monitoring program was begun at the Vitro processing site. The purpose of the program was to evaluate how irrigating the new golf driving range affected ground water elevations in the unconfined aquifer. The program also evaluated potential impacts of a 9-hole golf course planned as an expansion of the driving range. The planned golf course expansion would increase the area to be irrigated and, thus, the water that could infiltrate the processing site soil to recharge the unconfined aquifer. Increased water levels in the aquifer could alter the ground water flow regime; contaminants in ground water could migrate off the site or could discharge to bodies of surface water in the area. The potential effects of expanding the golf course have been evaluated, and a report is being prepared. Water level data obtained during this monitoring program indicate that minor seasonal mounding may be occurring in response to irrigation of the driving range. However, the effects of irrigation appear small in comparison to the effects of precipitation. There are no monitor wells in the area that irrigation would affect most; that data limitation makes interpretations of water levels and the possibility of ground water mounding uncertain. Limitations of available data are discussed in the conclusion.

21002 (DOE/AL/82993–10) **Phase II – Photovoltaics for Utility Scale Applications (PVUSA): Safety and health action plan.** Berg, K. Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development. Sep 1994. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95013804. Source: OSTI; NTIS; GPO Dep.

To establish guidelines for the implementation and administration of an injury and illness prevention program for PVUSA and to assign specific responsibilities for the execution of the program. To provide a basic Safety and Health Action Plan (hereinafter referred to as Plan) that assists management, supervision, and project personnel in the recognition, evaluation, and control of hazardous activities and/or conditions within their respective areas of responsibility.

21003 (DOE/EA–0948) **Environmental assessment operation of the HB-Line facility and frame waste recovery process for production of Pu-238 oxide at the Savannah River Site.** USDOE Savannah River Operations Office, Aiken, SC (United States). Apr 1995. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013800. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-0948, addressing future operations of the HB-Line facility and the Frame Waste Recovery process at the Savannah River Site (SRS), near Aiken, South Carolina. Based on the analyses in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, DOE has concluded that, the preparation of an environmental impact statement is not required, and is issuing this Finding of No Significant Impact.

21004 (DOE/EA–1034) **Replacement of the Idaho National Engineering Laboratory Health Physics Instrumentation Laboratory.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). May 1995. 39p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013826. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE-Idaho Operations Office (DOE-ID) has prepared an environmental assessment (EA) on the replacement of the Idaho National Engineering Laboratory Health Physics Instrumentation Laboratory at the Idaho National Engineering Laboratory (INEL). The purpose of this project is to replace the existing Health Physics Instrumentation Laboratory (HPIL) with a new facility to provide a safe environment for maintaining and calibrating radiation detection instruments used at the Idaho National Engineering Laboratory. The existing HPIL facility provides portable health physics monitoring instrumentation and direct reading dosimetry procurement, maintenance and calibration of radiation detection instruments, and research and development support-services to the INEL and others. However, the existing facility was not originally designed for laboratory activities and does not provide an adequate, safe environment for calibration activities. The EA examined the potential environmental impacts of the proposed action and evaluated reasonable alternatives, including the no action alternative in accordance with the Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500-1508). Based on the environmental analysis in the attached EA, the proposed action will not have a significant effect on the human environment within the

meaning of the National Environmental Policy Act (NEPA) and 40 CFR Parts 1508.18 and 1508.27. The selected action (the proposed alternative) is composed of the following elements, each described or evaluated in the attached EA on the pages referenced. The proposed action is expected to begin in 1997 and will be completed within three years: design and construction of a new facility at the Central Facility Area of the INEL; operation of the facility, including instrument receipt, inspections and repairs, precision testing and calibration, and storage and issuance. The selected action will result in no significant environmental impacts.

21005 (DOE/EH–0488) **OSHWPP model programs guide.** USDOE Energy Information Administration, Washington, DC (United States). Office of Safety and Quality Assurance. Jun 1995. 87p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013851. Source: OSTI; NTIS; GPO Dep.

Descriptions of model occupational health and safety programs implemented at DOE facilities are presented.

21006 (DOE/EIS–0198) **Draft programmatic environmental impact statement for the Uranium Mill Tailings Remedial Action Ground Water Project.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1995. 251p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95011264. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is responsible for performing remedial action to bring surface and ground water contaminant levels at 24 inactive uranium processing sites into compliance with the US Environmental Protection Agency (EPA) standards. DOE is accomplishing this through the Uranium Mill Tailings Remedial Action (UMTRA) Surface and Ground Water Projects. Remedial action will be conducted with the concurrence of the US Nuclear Regulatory Commission (NRC) and the full participation of affected states and Indian tribes. Uranium processing activities at most of 24 the inactive mill sites resulted in the contamination of ground water beneath and, in some cases, downgradient of the sites. This contaminated ground water often has elevated levels of constituents such as uranium and nitrate. The purpose of the UMTRA Ground Water Project is to eliminate, or reduce to acceptable levels, the potential health and the environmental consequences of milling activities by meeting the EPA standards in areas where ground water has been contaminated. The first step in the UMTRA Ground Water Project is the preparation of this programmatic environmental impact statement (PEIS). This document analyzes potential impacts of four programmatic alternatives, including the proposed action. The alternatives do not address site-specific ground water compliance strategies. Rather, the PEIS is a planning document that provides a framework for conducting the Ground Water Project; assesses the potential programmatic impacts of conducting the Ground Water Project; provides a method for determining the site-specific ground water compliance strategies; and provides data and information that can be used to prepare site-specific environmental impacts analyses more efficiently.

21007 (DOE/EM–0232-Vol.2) **Estimating the cold war mortgage: The 1995 baseline environmental management report. Volume II: Site summaries.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Mar 1995. 740p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012533. Source: OSTI; NTIS; INIS; GPO Dep.

This volume, Volume II presents the site data that was used to generate the Department of Energy's (DOE) initial Baseline Environmental Management Report (BEMR). The raw data was obtained by DOE field personnel from existing information sources and anticipated environmental management strategies for their sites and was tempered by general assumptions and guidance developed by DOE Headquarters personnel. This data was then integrated by DOE Headquarters personnel and modified to ensure that overall constraints such as funding and waste management capacity were addressed. The site summaries are presented by State and broken out by discrete activities and projects. The Volume I Glossary has been repeated to facilitate the reader's review of Volume II. The information presented in the site summaries represents the best data and assumptions available as of February 1, 1995. Assumptions that have not been mandated by formal agreement with appropriate regulators and other stakeholders do not constitute decisions by the Department nor do they supersede existing agreements. In addition, actions requiring decisions from external sources regarding unknowns such as future land use and funding/scheduling alternatives, as well as internal actions such as the Department's Strategic Realignment initiative, will alter the basis and general assumptions used to generate the results for this report. Consequently, the numbers presented in the site summaries do not represent outyear budget requests by the field installations.

21008 (DOE/EM–0234) **Cost quality management assessment report for the Kansas City Plant. Final report.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Office of Engineering and Cost Management. Apr 1995. 104p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011865. Source: OSTI; NTIS; GPO Dep.

The Office of Engineering and Cost Evaluation (EM-24) conducted a Cost Quality Management Assessment (CQMA) at the Kansas City Plant (KCP) on March 16-27, 1992. The Round II CQMA at the KCP, conducted August 22-31, 1994, reviewed KCP's cost and cost-related management practices against POCs contained in the CQMA Site Handbook. Interviews of Department of Energy Kansas City Area Office (DOE-KCAO) and AlliedSignal personnel and a review of documents show that KCP has made measurable progress since the last CQMA. Of the 48 POCs, KCP meets 31 and partially meets 17. Among the key observations are the following: The DOE-KCAO and AlliedSignal are effectively managing the Environmental Restoration (ER) baseline, validated in FY 1992, through Baseline Change Control Procedures. KCP ER baseline performance is on schedule and under budget. Remedial Action at the KCP is expected to be completed by FY 2000. After FY 2000, only Waste Management (WM) operations in support of Defense Programs will be required. KCP has initiated a Baseline Change Proposal to combine five planned Corrective Measures Studies into one; the expected cost avoidance is $1M. AlliedSignal used the CQMA Handbook (Rev. 0) and the Action Plan developed in response to the Round I CQMA as a basis for improving cost-management systems, processes, and procedures. AlliedSignal is standardizing on Project 2/Series X software for baseline scheduling and cost and schedule performance reporting. For estimating environmental restoration and construction projects, AlliedSignal is converting to Composer Gold software, the commercial version Of MCACES Software developed by the U.S. Army Corps of Engineers. AlliedSignal is beginning to generate a site-specific database in Composer Gold for more accurately estimating constriction and remediation projects. The roles and responsibilities of DOE-KCAO and AlliedSignal managers and staff need to be clarified given the recent reorganization of AlliedSignal.

21009 (DOE/OR–01-1326-D1/V1) **Remedial investigation report on Waste Area Group 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Volume 1: Technical summary.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); Ogden Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Mar 1995. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–284-D1/V1; ORNL/ER/Sub–87-99053/76/V1). Order Number DE95012491. Source: OSTI; NTIS; INIS; GPO Dep.

A remedial investigation (RI) was performed to support environmental restoration activities for Waste Area Grouping (WAG) 5 at the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. The WAG 5 RI made use of the observational approach, which concentrates on collecting only information needed to assess site risks and support future cleanup work. This information was interpreted and is presented using the framework of the site conceptual model, which relates contaminant sources and release mechanisms to migration pathways and exposure points that are keyed to current and future environmental risks for both human and ecological receptors. The site conceptual model forms the basis of the WAG 5 remedial action strategy and remedial action objectives.

The RI provided the data necessary to verify this model and allows recommendations to be made to accomplish those objectives.

21010 (DOE/OR–01-1326-D1/V2) **Remedial investigation report on Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Volume 2, Appendix A: Characterization methods and data summary.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); Ogden Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Mar 1995. 335p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–284-D1/V2; ORNL/ER/Sub–87-99053/76/V2). Order Number DE95012490. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix presents background regulatory and technical information regarding the solid waste management units (SWMUs) at Waste Area Grouping (WAG) 5 to address requirements established by the Federal Facility Agreement (FFA) for the Oak Ridge Reservation (ORR). The Department of energy (DOE) agreed to conduct remedial investigations (RIs) under the FFA at various sites at Oak Ridge National Laboratory (ORNL), including SWMUs and other areas of concern on WAG 5. The appendix gives an overview of the regulatory background to provide the context in which the WAG 5 RI was planned and implemented and documents how historical sources of data, many of which are SWMU-specific, were evaluated and used.

21011 (DOE/OR–01-1326-D1/V3) **Remedial investigation report on Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Volume 3, Appendix B, Technical findings and conclusions.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); Ogden Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Mar 1995. 433p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–284-D1/V3; ORNL/ER/Sub–87-99053/76/V3). Order Number DE95012492. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Investigation Report on Waste Area Grouping, (NVAG) 5 at Oak Ridge National Laboratory was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for reporting, the results of a site chacterization for public review. This work was performed under Work Breakdown Structure 1.4.12.6.1.05.40.02 (Activity Data Sheet 3305, "WAG 5"). Publication of this document meets a Federal Facility Agreement milestone of March 31, 1995. This document provides the Environmental Restoration Program with information about the results of investigations performed at WAG 5. It includes information on risk assessments that have evaluated long-term impacts to human health and the environment. Information provided in this document forms the basis for decisions regarding, the need for subsequent remediation work at WAG 5.

21012 (DOE/OR–01-1326-D1/V4) **Remedial investigation report on Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Volume 4: Appendix C, Risk assessment.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); Ogden Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Mar 1995. 959p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Subcontract 95B-99053C. (ORNL/ER–284-D1/V4; ORNL/ER/Sub–87-99053/76/V4). Order Number DE95012540. Source: OSTI; NTIS; INIS; GPO Dep.

Waste Area Grouping (WAG) 5 is part of Oak Ridge National Laboratory (ORNL) and is located on the United States Department of Energy's Oak Ridge Reservation (DOE-ORR). The site lies southeast of Haw Ridge in Melton Valley and comprises approximately 32 ha (80 ac) [12 ha (30 ac) of forested area and the balance in grassed fields]. The western and southern boundaries of WAG are contiguous with the WAG 2 area which includes White Oak Creek and Melton Branch and associated floodplains. Waste Area Grouping 5 consists of several contaminant source areas for the disposal of low-level radioactive, transuranic (TRU), and fissile wastes (1959 to 1973) as well as inorganic and organic chemical wastes. Wastes were buried in trenches and auger holes. Radionuclides from buried wastes are being transported by shallow groundwater to Melton Branch and White Oak Creek. Different chemicals of potential concern (COPCS) were identified (e.g., cesium-137, strontium-90, radium-226, thorium-228, etc.); other constituents and chemicals, such as vinyl chloride, bis(2-ethylhexyl)phthalate, trichloroethene, were also identified as COPCS. Based on the results of this assessment contaminants of concern (COCS) were subsequently identified. The human health risk assessment methodology used in this risk assessment is based on Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). First, the data for the different media are evaluated to determine.usability for risk assessment. Second, through the process of selecting COPCS, contaminants to be considered in the BHHRA are identified for each media, and the representative concentrations for these contaminants are determined. Third, an assessment of exposure potential is performed, and exposure pathways are identified. Subsequently, exposure is estimated quantitatively, and the toxicity of each of the COPCs is determined. The results of the exposure and toxicity assessments are combined and summarized in the risk characterization section.

21013 (DOE/OR/22160–T17) **Demonstration testing and evaluation of in situ soil heating. Management Plan, Revision 2.** Dev, H. IIT Research Inst., Chicago, IL (United States). 6 Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-93OR22160. Order Number DE95007851. Source: OSTI; NTIS; INIS; GPO Dep.

This is the second revision to the Management Plan for US DOE contract entitled, "Demonstration Testing and Evaluation of In Situ Soil Heating," Contract Number DE-AC05-93OR22160, IITRI Project Number C06787. The cost plan and schedule have been revised herein. The Management Plan was revised once before, in March 1994. In this project IITRI will demonstrate its in situ soil heating and decontamination technology which uses 60 Hz AC power to heat soil to a temperature of about 900C. This technology is aimed at the decontamination of soil by the removal of organic hazardous constituents by the action of heat and a vacuum gas collection system.

21014 (DOE/RL–94-107-Rev.1) **Radioactive air emissions program notice of construction for the decommissioning of the 233-S Plutonium Concentration Facility Complex. Revision 1.** USDOE Richland Operations Office, WA (United States); Bechtel Hanford, Inc., Richland, WA (United States). Oct 1994. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-93RL12367. Order Number DE95007975. Source: OSTI; NTIS; INIS; GPO Dep.

This Notice of Construction (NOC) presents the required information regarding Phase 1 and 2 of the decommissioning of the 233-S Plutonium Concentration Facility Complex (233-S Complex). Phase 1 includes preparing the site, setting up temporary containments where required, removing inventory and equipment, and final decontamination of the structure. Phase 2 includes dismantling and removing the structure and final site stabilization. The project will include techniques that minimize the volume of the waste. Radioisotopes found include neptunium 237, plutonium 237, 238, 239, 240, 241, and 242, and americium 241. The 233-S building was designed and operated to concentrate the plutonium solutions generated by the REDOX Plant using an ion-exchange process. The process was expanded in 1962 to include neptunium received from the REDOX Plant.

21015 (DUN–2903-RD) **Draft of Mission No. 8 Nuclear Safety Program.** Douglas United Nuclear, Inc., Richland, WA (United States). 28 Jul 1967. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012654. Source: OSTI; NTIS; GPO Dep.

The Nuclear Safety Program at the Richland facilities consists of seven, concurrent subprograms. Which are: Fuel Temperature Transients Under Accident Conditions; Chemical and Metallurgical Reactions and Fission Product Release from Overheated Fuel; Control of Fission Gases; Meteorological Studies; Ground Fixation of Radioactive Material in Liquid Wastes; Particle Formation and

Release from Overheated Nuclear Material; and Seismic Studies. The Scope and Objective and Incentives of the overall program are discussed and details provided on each of the seven subprograms.

21016 (NUREG–1496-Vol.1) **Generic environmental impact statement in support of rulemaking on radiological criteria for decommissioning of NRC-licensed nuclear facilities. Main report; Draft report for comment: Volume 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Aug 1994. 165p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The action being considered in this draft Generic Environmental Impact Statement (GEIS) is an amendment to the Nuclear Regulatory Commission's (NRC) regulations in 10 CFR Part 20 to include radiological criteria for decommissioning of lands and structures at nuclear facilities. Under the National Environmental Policy Act (NEPA), all Federal agencies must consider the effect of their actions on the environment. To fulfill NRC's responsibilities under NEPA, the Commission is preparing this GEIS which analyzes alternative courses of action and the costs and impacts associated with those alternatives. In preparing the GEIS, the following approach was taken: (1) a listing was developed of regulatory alternatives for establishing radiological criteria for decommissioning; (2) for each alternative, a detailed analysis and comparison of incremental impacts, both radiological and nonradiological, to workers, members of the public, and the environment, and costs, were performed; and (3) based on the analysis of impacts and costs, preliminary recommendations were provided. Contained in the GEIS are recommendations related to the definition of decommissioning, the scope of rulemaking, the radiological criteria, restrictions on use, citizen participation, use of the GEIS in site-specific cases, and minimization of contamination.

21017 (NUREG–1496-Vol.2) **Generic environmental impact statement in support of rulemaking on radiological criteria for decommissioning of NRC-licensed nuclear facilities. Appendices; Draft report for comment – Volume 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Aug 1994. 574p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The action being considered in this draft Generic Environmental Impact Statement (GEIS) is an amendment to the Nuclear Regulatory Commission's (NRC) regulations in 10 CFR Part 20 to include radiological criteria for decommissioning of lands and structures at nuclear facilities. Under the National Environmental Policy Act (NEPA), all Federal agencies must consider the effect of their actions on the environment. To fulfill NRC's responsibilities under NEPA, the Commission is preparing this GEIS which analyzes alternative courses of action and the costs and impacts associated with those alternatives. In preparing the GEIS, the following approach was taken: (1) a listing was developed of regulatory alternatives for establishing radiological criteria for decommissioning; (2) for each alternative, a detailed analysis and comparison of incremental impacts, both radiological and nonradiological, to workers, members of the public, and the environment, and costs, were performed; and (3) based on the analysis of impacts and costs, preliminary recommendations were provided. Contained in the GEIS are recommendations related to the definition of decommissioning, the scope of rulemaking, the radiological criteria, restrictions on use, citizen participation, use of the GEIS in site-specific cases, and minimization of contamination.

21018 (NUREG–1500) **Working draft regulatory guide on release criteria for decommissioning: NRC staff's draft for comment.** Daily, M.C.; Huffert, A.; Cardile, F.; Malaro, J.C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Aug 1994. 166p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The Nuclear Regulatory Commission's (NRC) regulations in 10 CFR 20 are being amended to include radiological criteria for decommissioning of lands and structures at nuclear facilities. 10 CFR Part 20, Subpart E establishes criteria for the remediation of contaminated sites or facilities that will allow their release for future use with or without restrictions. The criteria include a Total Effective Dose Equivalent (TEDE) limit of 15 mrem/year (0.15 mSv/y) that should not be exceeded by an average individual among those who could potentially receive the greatest exposure from any residual activity within a facility or on a site. The criteria also require a licensee to reduce any residual radioactivity to as-low-as-reasonably-achievable (ALARA) levels. This staff draft guide describes acceptable procedures for determining the predicted dose level (PDL) from any residual radioactivity at the site. It describes the basic features of the calculational models and the associated default assumptions and parameter values the NRC staff would find acceptable in calculating PDLs. Appendices A, B, and C provide numerical values that can be used to estimate the dose from residual radioactivity remaining at a site. Since 10 CFR Part 20, Subpart E introduces several new concepts, definitions and discussions are included in a regulatory position concepts section of the guide to assist licensees in understanding some of the philosophy underlying the rule.

21019 (ORNL/ER/Sub–87-99053/75) **Site characterization report for the Old Hydrofracture Facility at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Jan 1995. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013228. Source: OSTI; NTIS; INIS; GPO Dep.

Several Old Hydrofracture Facility (OHF) structures (i.e., Building 7852, the bulk storage bins, the pump house, water tank T-5, and pump P-3) are surplus facilities at Oak Ridge National Laboratory (ORNL) slated for decontamination and decommissioning (D and D). OHF was constructed in 1963 to allow experimentation and operations with an integrated solids storage, handling, mixing, and grout injection facility. It was shut down in 1980 and transferred to ORNL's Surveillance and Maintenance Program. The hydrofracture process was a unique disposal method that involved injecting waste materials mixed with grout and additives under pumping pressures of 2,000 psi or greater into a deep, low-permeability shale formation. The injected slurry spread along fractures and bedding planes for hundreds of feet from the injection points, forming thin grout sheets (often less than 1/8 in. thick). The grout ostensibly immobilized and solidified the liquid wastes. Site characterization activities were conducted in the winter and spring of 1994 to collect information necessary to plan the D and D of OHF structures. This site characterization report documents the results of the investigation of OHF D and D structures, presenting data from the field investigation and laboratory analyses in the form of a site description, as-built drawings, summary tables of radiological and chemical contaminant concentrations, and a waste volume estimate. 25 refs., 54 figs., 17 tabs.

21020 (ORNL/TM–12985) **Cost results from the 1994 Fernald characterization field demonstration for uranium-contaminated soils.** Douthat, D.M.; Stewart, R.N.; Armstrong, A.Q. Oak Ridge National Lab., TN (United States). Apr 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012541. Source: OSTI; NTIS; INIS; GPO Dep.

One of the principal objectives of the US Department of Energy (DOE) Office of Technology Development is to develop an optimum integrated system of technologies for removing uranium substances from soil. This system of technologies, through demonstration, must be proven in terms of cost reduction, waste minimization, risk reduction, and user applicability. To evaluate the effectiveness of these technologies, a field demonstration was conducted at the Fernald site in the summer of 1994. Fernald was selected as the host site for the demonstration based on environmental problems stemming from past production of uranium metal for defense-related applications. The following six alternative technologies were developed and/or demonstrated by the principal investigators in the Characterization Task Group at the field demonstration: (1) beta scintillation detector by Pacific Northwest Laboratory (PNL), (2) in situ gamma detector by PNL, (3) mobile laser ablation-inductively coupled plasma/atomic emission spectrometry (LA-ICP/AES) laboratory by Ames Laboratory, (4) long-range alpha detector (LRAD)

by Los Alamos National Laboratory (LANL), (5) passive radon monitoring by ORNL, and (6) electret ion chamber by ORNL.

21021 (PNL–10397) **Concentrations of radionuclides in terrestrial vegetation on the Hanford site of potential interest to Native Americans.** Poston, T.M. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010422. Source: OSTI; NTIS; INIS; GPO Dep.

Concentrations of ^{90}Sr and ^{137}Cs in Carey's balsamroot (Balsamorhiza careyana) and Gray's desert parsley (Lomatium grayi) were similar to concentrations observed in other plants collected on the Hanford Site and from offsite locations surrounding the Site as part of annual Hanford Site surveillance. Observed concentrations may be attributed to historic fallout more than to Hanford Site emissions, although the observation that 200 Area plants had slightly higher concentrations of ^{137}Cs than 100 Area plants is consistent with other monitoring data of radioactivity in soil and vegetation collected onsite. The present concentrations of ^{90}Sr and ^{137}Cs in balsamroot and parsley fluctuate around background levels with some of the higher observed concentrations of ^{90}Sr found on the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve. Analytical results and summary statistics by species and location are presented in the appendixes.

21022 (PNL–10524) **Arid sites stakeholder participation in evaluating innovative technologies: VOC-Arid Site Integrated Demonstration.** Peterson, T.S. (and others); McCabe, G.H.; Brockbank, B.R. Pacific Northwest Lab., Richland, WA (United States). May 1995. 192p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012395. Source: OSTI; NTIS; GPO Dep.

Developing and deploying innovative environmental cleanup technologies is an important goal for the U.S. Department of Energy (DOE), which faces challenging remediation problems at contaminated sites throughout the United States. Achieving meaningful, constructive stakeholder involvement in cleanup programs, with the aim of ultimate acceptance of remediation decisions, is critical to meeting those challenges. DOE's Office of Technology Development sponsors research and demonstration of new technologies, including, in the past, the Volatile Organic Compounds Arid Site Integrated Demonstration (VOC-Arid ID), hosted at the Hanford Site in Washington State. The purpose of the VOC-Arid ID has been to develop and demonstrate new technologies for remediating carbon tetrachloride and other VOC contamination in soils and ground water. In October 1994 the VOC-Arid ID became a part of the Contaminant Plume Containment and Remediation Focus Area (Plume Focus Area). The VOC Arid ID's purpose of involving stakeholders in evaluating innovative technologies will now be carried on in the Plume Focus Area in cooperation with Site Technology Coordination Groups and Site Specific Advisory Boards. DOE's goal is to demonstrate promising technologies once and deploy those that are successful across the DOE complex. Achieving that goal requires that the technologies be acceptable to the groups and individuals with a stake in DOE facility cleanup. Such stakeholders include groups and individuals with an interest in cleanup, including regulatory agencies, Native American tribes, environmental and civic interest groups, public officials, environmental technology users, and private citizens. This report documents the results of the stakeholder involvement program, which is an integral part of the VOC-Arid ID.

21023 (PNL-SA–25501) **Radiation screening of excavated waste at Hanford's 118-B-1 burial site.** Stromswold, D.C. (Pacific Northwest Lab., Richland, WA (United States)); Alvarez, J.L.; Davis, A.I.; Duce, S.W.; Frain, J.; Ludowise, J.D. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950495–1: 7. national technology information exchange workshop, Cincinnati, OH (United States), 18-20 Apr 1995). Order Number DE95010724. Source: OSTI; NTIS; INIS; GPO Dep.

Radiation measurements on items excavated from a radioactive-waste burial ground were part of a field test of excavation, radiation screening, and waste sorting techniques being evaluated for the cleanup of Hanford burial sites. The radiation measurements investigated techniques for classifying bulk waste for placement into an environmental restoration disposal facility. Hand-held gamma-ray survey instruments measured exposure rates (mR/h) from contaminated dirt and radioactive objects as they were removed by heavy excavation equipment. Gamma-ray detectors mounted on the excavation equipment provided additional data that were transmitted by radio telemetry. Exposure rates from identifiable objects (e.g., specific reactor components) were compared with expected exposure rates calculated from site-disposal records and computer modeling. Selected objects were subjected to additional on-site measurements using a high-purity germanium detector. The germanium detector enabled specific radioisotope identification based on gamma-ray energies. It also provided a measure of the concentration of gamma-ray-emitting contaminants in soils and the activity of specific objects, based on prior calibration for both distributed and point sources. A large-area neutron detector checked for possible transuranic nuclides. Alpha and beta spectrometry also were tested, but their utility for this application was limited due to the short range of the particles and the difficulty of maintaining a repeatable measurement geometry in field measurements.

21024 (POEF-SH–29) **Evaluation of coverage of enriched UF_6 cylinder storage lots by existing criticality accident alarms.** Lee, B.L. Jr.; Dobelbower, M.C.; Woollard, J.E.; Sutherland, P.J.; Tayloe, R.W. Jr. Martin Marietta Energy Systems, Inc., Piketon, OH (United States). Mar 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE95010274. Source: OSTI; NTIS; INIS; GPO Dep.

The Portsmouth Gaseous Diffusion Plant (PORTS) is leased from the US Department of Energy (DOE) by the United States Enrichment Corporation (USEC), a government corporation formed in 1993. PORTS is in transition from regulation by DOE to regulation by the Nuclear Regulatory Commission (NRC). One regulation is 10 CFR Part 76.89, which requires that criticality alarm systems be provided for the site. PORTS originally installed criticality accident alarm systems in all building for which nuclear criticality accidents were credible. Currently, however, alarm systems are not installed in the enriched uranium hexafluoride (UF_6) cylinder storage lots. This report analyzes and documents the extent to which enriched UF_6 cylinder storage lots at PORTS are covered by criticality detectors and alarms currently installed in adjacent buildings. Monte Carlo calculations are performed on simplified models of the cylinder storage lots and adjacent buildings. The storage lots modelled are X-745B, X-745C, X745D, X-745E, and X-745F. The criticality detectors modelled are located in building X-343, the building X-344A/X-342A complex, and portions of building X-330 (see Figures 1 and 2). These criticality detectors are those located closest to the cylinder storage lots. Results of this analysis indicate that the existing criticality detectors currently installed at PORTS are largely ineffective in detecting neutron radiation from criticality accidents in most of the cylinder storage lots at PORTS, except sometimes along portions of their peripheries.

21025 (RFP–4826) **Evaluation of residue drum storage safety risks.** Conner, W.V. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 17 Jun 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. Order Number DE95011899. Source: OSTI; NTIS; INIS; GPO Dep.

A study was conducted to determine if any potential safety problems exist in the residue drum backlog at the Rocky Flats Plant. Plutonium residues stored in 55-gallon drums were packaged for short-term storage until the residues could be processed for plutonium recovery. These residues have now been determined by the Department of Energy to be waste materials, and the residues will remain in storage until plans for disposal of the material can be developed. The packaging configurations which were safe for short-term storage may not be safe for long-term storage. Interviews with Rocky Flats personnel involved with packaging the residues reveal that more than one packaging configuration was used for some of the residues. A tabulation of packaging configurations was developed based on the information obtained from the interviews. A number of potential safety problems were identified

during this study, including hydrogen generation from some residues and residue packaging materials, contamination containment loss, metal residue packaging container corrosion, and pyrophoric plutonium compound formation. Risk factors were developed for evaluating the risk potential of the various residue categories, and the residues in storage at Rocky Flats were ranked by risk potential. Preliminary drum head space gas sampling studies have demonstrated the potential for formation of flammable hydrogen-oxygen mixtures in some residue drums.

21026 (SAND–94-0686) **Determination of kinetic coefficients for the simultaneous reduction of sulfate and uranium by Desulfovibrio desulfuricans bacteria.** Tucker, M.D. Sandia National Labs., Albuquerque, NM (United States). May 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011839. Source: OSTI; NTIS; INIS; GPO Dep.

Uranium contamination of groundwaters and surface waters near abandoned mill tailings piles is a serious concern in many areas of the western United States. Uranium usually exists in either the U(IV) or the U(VI) oxidation state. U(VI) is soluble in water and, as a result, is very mobile in the environment. U(IV), however, is generally insoluble in water and, therefore, is not subject to aqueous transport. In recent years, researchers have discovered that certain anaerobic microorganisms, such as the sulfate-reducing bacteria Desulfovibrio desulfuricans, can mediate the reduction of U(VI) to U(IV). Although the ability of this microorganism to reduce U(VI) has been studied in some detail by previous researchers, the kinetics of the reactions have not been characterized. The purpose of this research was to perform kinetic studies on Desulfovibrio desulficans bacteria during simultaneous reduction of sulfate and uranium and to determine the phase in which uranium exists after it has been reduced and precipitated from solution. The studies were conducted in a laboratory-scale chemostat under substrate-limited growth conditions with pyruvate as the substrate. Kinetic coefficients for substrate utilization and cell growth were calculated using the Monod equation. The maximum rate of substrate utilization (k) was determined to be 4.70 $days^{-1}$ while the half-velocity constant (K_s) was 140 mg/l COD. The yield coefficient (Y) was determined to be 0.17 mg cells/mg COD while the endogenous decay coefficient (k_d) was calculated as 0.072 $days^{-1}$. After reduction, U(IV) Precipitated from solution in the uraninite (UO_2) phase. Uranium removal efficiency as high as 90% was achieved in the chemostat.

21027 (SAND–94-3188C) **Successful remediation of four uranium calibration pits at Technical Area II, Sandia National Laboratories, Albuquerque, New Mexico, USA.** Conway, R. (Sandia National Labs., Albuquerque, NM (United States)); Wade, M.; Tharp, T.; Copland, J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950917–1: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95006308. Source: OSTI; NTIS; INIS; GPO Dep.

The first remediation of an Environmental Restoration (ER) Project site at Sandia National Laboratories (SNL) was successfully conducted in May and June 1994 at Technical Area II. The removal action involved four Uranium Calibration Pits (UCPs) filled with radioactive or hazardous materials. The concrete culvert pits were used to test and calibrate borehole radiometric logging tools for uranium exploration. The removal action consisted of excavating and containerizing the pit contents and contaminated soil beneath the culverts, removing the four culverts, and backfilling the excavation. Each UCP removal had unique complexities. Sixty 208-L drums of solid radioactive waste and eight 208-L drums of liquid hazardous waste were generated during the VCM. Two of the concrete culverts will be disposed as radioactive waste and two as solid waste. Uranium-238 was detected in UCP-2 ore material at 746 pci/g, and at 59 pci/g in UCP-1 silica sand. UCP-4 was empty; sludge from UCP-3 contained 122 mg/L (ppm) chromium.

21028 (SAND–95-1246) **Kauai Test Facility hazards assessment document.** Swihart, A. Sandia National Labs., Albuquerque, NM (United States). May 1995. 369p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013854. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy Order 55003A requires facility-specific hazards assessment be prepared, maintained, and used for emergency planning purposes. This hazards assessment document describes the chemical and radiological hazards associated with the Kauai Test Facility, Barking Sands, Kauai, Hawaii. The Kauai Test Facility's chemical and radiological inventories were screened according to potential airborne impact to onsite and offsite individuals. The air dispersion model, ALOHA, estimated pollutant concentrations downwind from the source of a release, taking into consideration the toxicological and physical characteristics of the release site, the atmospheric conditions, and the circumstances of the release. The greatest distance to the Early Severe Health Effects threshold is 4.2 kilometers. The highest emergency classification is a General Emergency at the "Main Complex" and a Site Area Emergency at the Kokole Point Launch Site. The Emergency Planning Zone for the "Main Complex" is 5 kilometers. The Emergency Planning Zone for the Kokole Point Launch Site is the Pacific Missile Range Facility's site boundary.

21029 (SAND–95-8216) **Radiological characterization plan for the Tritium Research Laboratory, Sandia National Laboratories/California.** Garcia, T. Sandia National Labs., Albuquerque, NM (United States). May 1995. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010746. Source: OSTI; NTIS; INIS; GPO Dep.

In this Radiological Characterization Plan (RCP), the Health Protection Department, 8641 of Sandia National Laboratories/California provides specific information for an assessment of the radiological conditions of Building 968, the Tritium Research Laboratory (TRL), and the TRL Complex area. This RCP provides historical background information on each laboratory within the TRL Complex as related to both radiological conditions and hazardous materials. Since this plan chronicles past and present activities and outlines future actions, a final complex status report will follow the completion of this document. The Health Protection Department, 8641 anticipates that the TRL Complex will ultimately undergo a termination survey; however, this RCP does not include environmental surveys such as soil, vegetation, or ground water. The RCP does provide the basis for a final termination survey plan, when appropriate.

21030 (UCRL-JC–119591) **Use of experience data for seismic evaluations at Department of Energy facilities.** Murray, R.C. (Lawrence Livermore National Lab., CA (United States)); Kimball, J.K.; Guzy, D.J.; Hill, J.R. Lawrence Livermore National Lab., CA (United States). 7 Dec 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941227–5: 5. symposium on current issues related to nuclear power plant structure, equipment and piping, Orlando, FL (United States), 14-16 Dec 1994). Order Number DE95011741. Source: OSTI; NTIS; INIS; GPO Dep.

Seismic evaluations of essential systems and components at Department of Energy (DOE) facilities will be conducted over the next several years. For many of these systems and components, few, if any, seismic requirements applied to the original design, procurement, installation, and maintenance process. Thus the verification of the seismic adequacy of existing systems and components presents a difficult challenge. DOE has undertaken development of the criteria and procedures for these seismic evaluations that will maximize safety benefits in a timely and cost effective manner. As demonstrated in previous applications at DOE facilities and by the experience from the commercial nuclear power industry, use of experience data for these evaluations is the only viable option for most existing systems and components. This paper describes seismic experience data, the needs at DOE facilities, the precedent of application of nuclear power plants and DOE facilities, and the program underway for the seismic verification task ahead for DOE.

21031 (WHC-EP–0600-Rev.1) **Status report on resolution of Waste Tank Safety Issues at the Hanford Site. Revision 1.** Dukelow, G.T. (Los Alamos Technical Associates, Inc., Kennewick, WA (United States)); Hanson, G.A. Westinghouse Hanford Co., Richland, WA (United States); Los Alamos Technical Associates, Inc., Kennewick, WA (United States). May 1995. 207p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012985. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to provide and update the status of activities supporting the resolution of waste tank safety issues and system deficiencies at the Hanford Site. This report provides: (1) background information on safety issues and system deficiencies; (2) a description of the Tank Waste Remediation System and the process for managing safety issues and system deficiencies; (3) changes in safety issue description, prioritization, and schedules; and (4) a summary of the status, plans, order of magnitude, cost, and schedule for resolving safety issues and system deficiencies.

21032 (WHC-SA–2746) **Deactivation and cleanout of the 308 Fuels Laboratory and the 232-Z Incinerator at the Hanford site.** Gerber, M.S.; Bliss, R.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950216–138: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95008788. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the deactivation and source term reduction activities conducted over the recent past in two plutonium-contaminated Hanford Site buildings: the 308 Fuels Development Laboratory and the 232-Z Incinerator. Both of these facilities belong to the U.S. Department of Energy, and the projects are unique success stories carried out in direct support of EM-60 functions and requirements. In both cases the buildings, for different reasons, contained unacceptable amounts of plutonium, and were stabilized and placed in a safe, pre-D&D (decontamination and decommissioning) mode. The concept of deactivation as the last step in the operating life of a facility will be discussed. The need for and requirements of EM-60 transition between operations and D&D, the costs savings, techniques, regulations and lessons learned also will be discussed. This paper describes the strategies that led to successful source term reduction: accurate characterization, cooperation among different divisions within DOE and the Hanford Site, attention to regulations (especially unique in this case since the 232-Z Incinerator has been nominated as a Historic Structure to the National Register of Historic Places), and stakeholder concerns involving the proximity of the 308 Building to the Columbia River. The paper also weaves in the history, missions, and plutonium accumulation of the two buildings. The lessons learned are cogent to many other present and future deactivation activities across the DOE complex and indeed across the world.

21033 (WHC-SA–2792) **Implementation strategies for U.S. DOE Order 5480.28 Natural Phenomena Hazards Mitigation.** Conrads, T.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950740–39: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95008789. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the strategies used by Westinghouse Hanford Company for implementing a new U.S. Department of Energy Order 5480.28, Natural Phenomena Hazards Mitigation. The order requires that all new and existing structures, systems, and components be designed and evaluated for the effects of natural phenomena (seismic, wind, flood, and volcano) applicable at a given site. It also requires that instrumentation be available to record the expected seismic events and that procedures be available to inspect facilities for damage following a natural phenomena event. This order requires that probabilistic hazards studies be conducted for the applicable natural phenomena to determine appropriate loads to be applied in a graded approach to structures, systems, and components important to safety. This paper discusses the processes, tasks, and methods used to implement this directive, which altered the standard design basis for new and existing structures, systems, and components at the Hanford Site. It also addresses a correlation between the performance category nomenclature of DOE Order 5480.28 and the safety classification described in DOE Order 5480.23, Nuclear Safety Analysis Reports. This correlation was deemed to be a prerequisite for the cost-effective implementation of the new DOE Order on natural phenomena hazards mitigation.

21034 (WHC-SA–2841) **Dose assessment from potential radionuclide emissions from stacks on the Hanford Site.** Davis, W.E.; Barnett, J.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9505101–4: Conference on challenges and innovations in the management of hazardous waste, Washington, DC (United States), 10-12 May 1995). Order Number DE95011572. Source: OSTI; NTIS; INIS; GPO Dep.

On February 3, 1993, the US Department of Energy, Richland Operations Office (RL), received a Compliance Order and Information Request from the Director of the Air and Toxics Division of the US Environmental Protection Agency (EPA), Region 10. The Compliance Order required RL to (1) evaluate all radionuclide emission points at the Hanford Site to determine which points are subject to the continuous emission sampling requirements of Title 40, Code of Federal Regulations, Part 61 (40 CFR 61), Subpart H, and (2) continuously sample radionuclide emissions in accordance with requirements in 40 CFR 61.93. The Information Request required RL to provide a written Compliance Plan to meet the requirements of the Compliance Order. A Compliance Plan was submitted to EPA, Region 10, on April 30, 1993. The Compliance Plan specified that a dose assessment would be performed for 84 Westinghouse Hanford Company (WHC) stacks registered with the Washington State Department of Health on the Hanford Site. Any stack identified in the assessment as having potential emissions to cause an effective dose equivalent (EDE) to a maximum exposed individual (MEI) greater than 0.1 mrem y^{-1} must have a compliant sampling system. In addition, a Federal Facility Compliance Agreement (FFCA) was signed on. February 7, 1994. The FFCA required that all unregistered stacks on the Hanford Site be assessed. This requirement increased the number of stacks to be assessed to 123 stacks. Six methods for performing the assessments are described. An initial assessment using only the HEPA filtration factor for back calculations identified 32 stacks that would have emissions which would cause an EDE to the MEI greater than 0.1 mrem y^{-1}. When the other methods were applied the number was reduced to 20 stacks. The paper discusses reasons for these overestimates.

21035 (WHC-SD-CP-SA–026-Rev.1) **Seismic analyses of equipment in 2736-Z complex. Revision 1.** Ocoma, E.C. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 863p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012487. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the structural qualification for the existing equipment when subjected to seismic loading in the Plutonium Storage Complex. It replaces in entirety Revision 0 and reconciles the U.S. Department of Energy (DOE) comments on Revision 0. The Complex consists of 2736-Z Building (plutonium storage vault), 2736-ZA Building (vault ventilation equipment building), and 2736-ZB Building (shipping/receiving, repackaging activities). The existing equipment structurally qualified in this report are the metal storage racks for 7 inch and lard cans in room 2 of Building 2736-Z; the cubicles, can holders and pedestals in rooms 1, 3, and 4 of Building 2736-Z; the ventilation duct including exhaust fans/motors, emergency diesel generator, and HEPA filter housing in Building 2736-ZA; the repackaging glovebox in Building 2736-ZB; and the interface duct between Buildings 2736-Z and 2736-ZA.

21036 (WHC-SD-ER5480-ER–001) **Hanford facilities tracer study report (315 Water Treatment Facility).** Ambalam, T. (Kaiser Engineers Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Kaiser Engineers Hanford Co., Richland, WA (United States). 14 Apr 1995. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010870. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results and findings of a tracer study to determine contact time for the disinfection process of 315 Water Treatment Facility that supplies sanitary water for the 300 Area.

The study utilized fluoride as the tracer and contact times were determined for two flow rates. Interpolation of data and short circuiting effects are also discussed. The 315 Water Treatment Facility supplies sanitary water for the 300 Area to various process and domestic users. The Surface Water Treatment Rule (SWTR), outlined in the 1986 Safe Drinking Water Act Amendments enacted by the EPA in 1989 and regulated by the Washington State Department of Health (DOH) in Section 246-290-600 of the Washington Administrative Code (WAC), stipulates filtration and disinfection requirements for public water systems under the direct influence of surface water. The SWTR disinfection guidelines require that each treatment system achieves predetermined inactivation ratios. The inactivation by disinfection is approximated with a measure called CxT, where C is the disinfectant residual concentration and T is the effective contact time of the water with the disinfectant. The CxT calculations for the Hanford water treatment plants were derived from the total volume of the contact basin(s). In the absence of empirical data to support CxT calculations, the DOH determined that the CxT values used in the monthly reports for the water treatment plants on the Hanford site were invalid and required the performance of a tracer study at each plant. In response to that determination, a tracer study will be performed to determine the actual contact times of the facilities for the CxT calculations.

21037 (WHC-SD-TP-RPT-015-Rev.1) **Transportation impact analysis for the shipment of low specific activity nitric acid. Revision 1.** Green, J.R. Westinghouse Hanford Co., Richland, WA (United States). 16 May 1995. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013330. Source: OSTI; NTIS; INIS; GPO Dep.

This is in support of the Plutonium-Uranium Extraction (PUREX) Facility Low Specific Activity (LSA) Nitric Acid Shipment Environmental Assessment. It analyzes potential toxicological and radiological risks associated with transportation of PUREX Facility LSA Nitric Acid from the Hanford Site to Portsmouth VA, Baltimore MD, and Port Elizabeth NJ.

21038 (WHC-SD-W164-ATP-001) **Fire alarm system acceptance test procedure for Project W-164, Sample Equipment Cleaning Facility.** McKenna, P.J. Westinghouse Hanford Co., Richland, WA (United States). 17 Apr 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010941. Source: OSTI; NTIS; INIS; GPO Dep.

This Acceptance Test Procedure (ATP) has been prepared to demonstrate that the Fire Protection System functions as required by project criteria. The test results will be issued as an acceptance test report (ATR) after all testing is complete. Components that are covered by this procedure are the fire alarm control system, power transfer to battery backup, switching circuits, alarm input devices, and battery capacity and recharge capability. Bldg 6268 is part of the Effluent Treatment and Laboratory Project.

21039 (WHC-SD-W320-SUP-002) **Project W-320 ALARA Plan.** Harty, W.M. Westinghouse Hanford Co., Richland, WA (United States). 6 Jun 1995. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014421. Source: OSTI; NTIS; INIS; GPO Dep.

This supporting document establishes the As Low As Reasonable Achievable (ALARA) Plan to be followed during Sluicing Project W-320 design and construction activities to minimize personnel exposure to radiation and hazardous materials.

21040 (WHC-SD-WM-ATP-125) **241-SY-101 Pump Decon System Acceptance Test Procedure.** Talachy, S.A.; Cleveland, K.J. Westinghouse Hanford Co., Richland, WA (United States). 12 Apr 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010574. Source: OSTI; NTIS; INIS; GPO Dep.

The SY-101 Pump Decon System has components that consist of the water filter skid to assembly operation, the pump pit flooding system, and the system set up using air blow the water out of the decon hose. The Acceptance Test Procedure (ATP) consists of four parts. The first part will calibrate water and flow meters. The second part will determine the pressure loss on the water traveling through the filter skid at various flow rates. The third part will determine the length of time it takes to drain 1350 gallons of water out of a tank through 300 feet of discharge hose. The fourth part will verify that the calculated air volume and pressure in an air receiver is adequate to blow all the water out of a 2 inch diameter water hose.

21041 (WHC-SD-WM-ES-315) **T Plant canyon deck-level allowable floor-load study.** Barlow, D.E. Westinghouse Hanford Co., Richland, WA (United States). 19 Apr 1995. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010942. Source: OSTI; NTIS; INIS; GPO Dep.

T Plant is to become a decontamination facility for the Hanford Site. This mission will require that large pieces of equipment be installed on the deck-level floor of the canyon in 221-T building. The objective of this study is to determine the maximum loads that can be applied safely to the canyon deck-level floor. These loads are caused by the weight of installed equipment. These load limits are to be used as design limits for the installation of the new equipment. The load limits for normal operating conditions are based on American Concrete Institute (ACI) 318.1 permissible stresses. The various floor configurations in building sections 1 through 20 are considered. Cover blocks are considered to be installed in all deck openings to create the worst possible case. The building is designated as safety class 3. The internal stresses, resulting from the inertial forces caused by the concrete during horizontal seismic accelerations, are out of scope for this report. They are considered in the seismic analysis of the building section. Vertical reactions when equipment is subjected to overturning moments during horizontal seismic accelerations must be determined and applied as part of the floor load. The new equipment to be installed has relatively small mass compared to the building weight, and there is a 25% reduction in the load factor during seismic events. Thus, the seismic effects are expected to be accommodated within the envelope of this static analysis.

21042 (WHC-SD-WM-FHA-010) **Fire hazard analysis of the radioactive mixed waste trenchs.** McDonald, K.M. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Columbia Energy and Environmental Services, Inc., Richland, WA (United States). 27 Apr 1995. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011509. Source: OSTI; NTIS; INIS; GPO Dep.

This Fire Hazards Analysis (FHA) is intended to assess comprehensively the risk from fire associated with the disposal of low level radioactive mixed waste in trenches within the lined landfills, provided by Project W-025, designated Trench 31 and 34 of the Burial Ground 218-W-5. Elements within the FHA make recommendations for minimizing risk to workers, the public, and the environment from fire during the course of the operation's activity. Transient flammables and combustibles present that support the operation's activity are considered and included in the analysis. The graded FHA contains the following elements: description of construction, protection of essential safety class equipment, fire protection features, description of fire hazards, life safety considerations, critical process equipment, high value property, damage potential–maximum credible fire loss (MCFL) and maximum possible fire loss (MPFL), fire department/brigade response, recovery potential, potential for a toxic, biological and/or radiation incident due to a fire, emergency planning, security considerations related to fire protection, natural hazards (earthquake, flood, wind) impact on fire safety, and exposure fire potential, including the potential for fire spread between fire areas. Recommendations for limiting risk are made in the text of this report and printed in bold type. All recommendations are repeated in a list in Section 18.0.

21043 (WHC-SP-0564-36) **Westinghouse Hanford Company health and safety performance report. Fourth quarter calendar year 1994.** Lansing, K.A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1995. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95008869. Source: OSTI; NTIS; GPO Dep.

Detailed information pertaining to As Low As Reasonably Achievable/Contamination Control Improvement Project (ALARA/CCIP) activities are outlined. Improved commitment to the WHC ALARA/CCIP Program was experienced throughout FY 1994. During CY

1994, 17 of 19 sitewide ALARA performance goals were completed on or ahead of schedule. Estimated total exposure by facility for CY 1994 is listed in tables by organization code for each dosimeter frequency. Facilities/areas continue to utilize the capabilities of the RPR tracking system in conjunction with the present site management action-tracking system to manage deficiencies, trend performance, and develop improved preventive efforts. Detailed information pertaining to occupational injuries/illnesses are provided. The Industrial Safety and Hygiene programs are described which have generated several key initiatives that are believed responsible for improved safety performance. A breakdown of CY 1994 occupational injuries/illnesses by type, affected body group, cause, job type, age/gender, and facility is provided. The contributing experience of each WHC division/department in attaining this significant improvement is described along with tables charting specific trends. The Radiological Control Program is on schedule to meet all RL Site Management System milestones and program commitments.

21044 (WHC-SP–0671-Rev.3) **Westinghouse Hanford Company ALARA year-end report, Calendar Year 1994: Revision 3, Radiological engineering and ALARA.** Berglund, O.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010571. Source: OSTI; NTIS; GPO Dep.

It has long been DOE's Policy that radiation exposures should be maintained as far below the dose limits as is reasonably achievable. This policy, known as the ALARA Principle of radiation protection, maintains that radiation exposures should be maintained as low as reasonably achievable, taking into account social, technical, economic, practical, and public policy considerations. The ALARA Principle is based on the hypothesis that even very low radiation doses carry some risk. As a result, it is not enough to maintain doses at/or slightly below limits; the lower the doses, the lower the risks. Because it is not possible to reduce all doses at DOE facilities to zero, economic and social factors must be considered to determine the optimal level of radiation doses. According to the ALARA principle, if doses are too high, resources should be well spent to reduce them. At some point, the resources being spent to maintain low doses are exactly balanced by the risks avoided. Reducing doses below this point results in a misallocation of resources; the resources could be spent elsewhere and have a greater impact on health and safety. The WHC ALARA sitewide goals were developed by the WHC ALARA Council and the ALARA/CCIP Program Office, while the facility/organizational level ALARA goals were developed by the facility/organizational ALARA committees. Goal statuses have been approved by facility management or their representative and transmitted verbatim in this report. These goals reflect a commitment by management to ensure a quality ALARA program driven by an emphasis on safety, the health of workers, and the protection of the environment. The final status, performance, and lessons learned of ALARA goals developed for Calendar Year (CY) 1994, are provided in this report.

21045 (WSRC-MS–94-0255) **The Savannah River Environmental Technology Field Test Platform: Phase 2.** Rossabi, J.; Riha, B.D.; Eddy-Dilek, C.A.; Pemberton, B.E.; May, C.P.; Jarosch, T.R.; Looney, B.B.; Raymond, R. Westinghouse Savannah River Co., Aiken, SC (United States). 14 Mar 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060138. Source: OSTI; NTIS; INIS; GPO Dep.

The principal goal in the development of new technologies for environmental monitoring and characterization is transferring them to organizations and individuals for use in site assessment and compliance monitoring. The DOE complex has devised several strategies to facilitate this transfer including joint research projects between private industries and government laboratories or universities (CRADAs) and streamlined licensing procedures. One strategy that has been under-utilized is a planned sequence gradually moving from laboratory development and field demonstration to long term evaluation and onsite use. Industrial partnership and commercial production can be initiated at any step based on the performance, market, user needs, and costs associated with the technology. This approach allows use of the technology by onsite groups for compliance monitoring tasks (e.g. Environmental Restoration and Waste Management), while following parallel research and development organizations the opportunity to evaluate the long term performance and to make modifications or improvements to the technology. This probationary period also provides regulatory organizations, potential industrial partners, and potential users with the opportunity to evaluate the technology's performance and its utility for implementation in environmental characterization and monitoring programs.

21046 (WSRC-MS–94-0628) **The visual and radiological inspection of a pipeline using a teleoperated pipe crawler.** Fogle, R.F. (Westinghouse Savannah River Co., Aiken, SC (United States). Savannah River Site); Kuelske, K.; Kellner, R. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9506178–1: International Association of Science and Technology for Development conference on robotics and manufacturing, Cancun (Mexico), 14-17 Jun 1995). Order Number DE95010964. Source: OSTI; NTIS; GPO Dep.

In the 1950s, the Savannah River Site built an open, unlined retention basin to temporarily store potentially radionuclide contaminated cooling water from a chemical separations process and storm water drainage from a nearby waste management facility that stored large quantities of nuclear fission byproducts in carbon steel tanks. The retention basin was retired from service in 1972 when a new, lined basin was completed. In 1978, the old retention basin was excavated, backfilled with uncontaminated dirt, and covered with grass. At the same time, much of the underground process pipeline leading to the basin was abandoned. Since the closure of the retention basin, new environmental regulations require that the basin undergo further assessment to determine whether additional remediation is required. A visual and radiological inspection of the pipeline was necessary to aid in the remediation decision making process for the retention basin system. A teleoperated pipe crawler inspection system was developed to survey the abandoned sections of underground pipelines leading to the retired retention basin. This paper will describe the background to this project, the scope of the investigation, the equipment requirements, and the results of the pipeline inspection.

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Refer also to citation(s) 20802, 21028, 22096, 22097

21047 (BNL–61068) **INFCIRC/153 as the basis for verification of a special nuclear materials production cutoff convention.** Parsick, R.; Sanborn, J. Brookhaven National Lab., Upton, NY (United States). Aug 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95005933. Source: OSTI; NTIS; INIS; GPO Dep.

Although safeguards practice under the Nuclear Non-Proliferation Treaty (NPT) has evolved considerably over the lifetime of the agreement, INFCIRC/153 remains the defining document of NPT verification. It is the only available document that might be adopted as an element of a special nuclear materials production cutoff convention to define an "NPT-like" verification regime. The clearly stated objective of INFCIRC/153 safeguards is the ability to "detect diversion," which is achieved by verifying the state's nuclear material accounting system. Although the way in which the verification objectives of a cutoff convention will be formulated is not yet known, it is clear that there will not be an exact fit between the two. The mismatch becomes greater to the extent that material in declared facilities is "grandfathered" under cutoff. It also increases as a cutoff regime focuses verification on the physical process of production (in operating facilities) or on facility operational status or capability (at non-operating facilities) rather than on the nuclear material itself. This paper compares the technical objectives which may be assigned to the IAEA under a cutoff convention with those described in INFCIRC/153. It also deals with means and limitations of verification activities which are closely linked to these objectives. The broader political and legal objectives associated with the convention are not considered.

21048 (DOE/MD–0001) **Storage and disposition of weapons-usable fissile materials Programmatic Environmental Impact Statement. Scoping meeting comment summary report.** USDOE Office of Fissile Materials Disposition, Washington, DC (United States). 30 Nov 1994. 221p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011045. Source: OSTI; NTIS; INIS; GPO Dep.

On September 27, 1993, President Clinton announced the establishment of a framework for US efforts to prevent proliferation of weapons of mass destruction. This policy commits the US to undertake a comprehensive approach to the growing accumulation of fissile materials from dismantled nuclear weapons and from within civil nuclear programs. In response to national policy, the Secretary of Energy, on January 24, 1994, created a Department wide project reporting to the Under Secretary, to focus on the control and disposition of surplus fissile materials and improve coordination of efforts within the Department concerning these fissile materials. Consequently, the Office of Fissile Materials Disposition was created and is responsible for all activities of the Department relating to the management, storage and disposition of fissile materials from weapons and weapons systems that are excess to the national security of the US.

21049 (LA–12929-MS) **IAEA safeguards for the Fissile Materials Disposition Project.** Close, D.A. Los Alamos National Lab., NM (United States). Jun 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012976. Source: OSTI; NTIS; INIS; GPO Dep.

This document is an overview of International Atomic Energy Agency (IAEA) safeguards and the basic requirements or elements of an IAEA safeguards regime. The primary objective of IAEA safeguards is the timely detection of the diversion of a significant quantity of material and the timely detection of undeclared activities. The two important components of IAEA safeguards to accomplish their primary objective are nuclear material accountancy and containment and surveillance. This overview provides guidance to the Fissile Materials Disposition Project for IAEA inspection requirements. IAEA requirements, DOE Orders, and Nuclear Regulatory Commission regulations will be used as the basis for designing a safeguards and security system for the facilities recommended by the Fissile Materials Disposition Project.

21050 (LA–12941-T) **A research study to determine the perception of security awareness within Los Alamos National Laboratory.** Kerstiens, F.L. Los Alamos National Lab., NM (United States); Phoenix Univ., AZ (United States). Dept. of Organizational Management. Apr 1995. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010680. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE is opening its doors and much of the Cold War secrets are being declassified. There still remains, however, much information which cannot be declassified at this time. The classified material which cannot be released coupled with new technology research and development still makes security a major issue within the DOE complex. Chapter 1 provides background information on the organizations involved in this research and a discussion of the problem. Three populations were selected for this research: EG and G/EM, a DOE contractor used by Los Alamos; a Los Alamos population of division identified as having committed a security infraction within the six months prior to this study; and a Los Alamos population who had not committed a security infraction during the same time frame. Since security within Los Alamos is still a major issue, the DOE periodically performs security audits to ensure DOE policies are being implemented and that security requirements are being met. This study analyzed security awareness perceptions and the possible relationship to infractions. Chapter 2 discusses other research that has been done in areas which relate directly to the seven hypotheses of this study. Chapter 3 deals with the methodology used to conduct the research. Surveys were sent out to randomly selected employees from each population. Chapter 4 discusses the collected data and presents the statistical results of the study. A detailed discussion of the data analyzed in Chapter 4 is presented in Chapter 5 with recommendations to management. This chapter also looks at the limitations of the study and the implications on future studies in this area.

21051 (LA–12964-MS) **Measuring the fill height of sealed cans with a compound pendulum.** Rinard, P.M. Los Alamos National Lab., NM (United States). Jun 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012975. Source: OSTI; NTIS; INIS; GPO Dep.

A compound pendulum has been designed, fabricated, tested, and used to determine the fill height of material in sealed cans. The specific cans that stimulated this work are partially filled with uranium and plutonium oxide. Fill height affects nondestructive assays using fission neutrons, but corrections for various fill heights can be made once the height is known. Heights vary with use as the powder compacts or loosens, so it is necessary to determine the height at the time of the neutron measurement. The pendulum is small and readily portable so it can be taken to the location of the neutron measurement. Tests with open cans filled with sand to various known heights had accuracies generally within 3%. Factors that can affect the accuracy are examined and discussed. Experience in using the pendulum on sealed cans is related.

21052 (LA-UR–95-323) **Precision estimates for tomographic nondestructive assay.** Prettyman, T.H. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950923–1: 5. international conference on facility-safeguards interface, Jackson Hole, WY (United States), 24-30 Sep 1995). Order Number DE95006279. Source: OSTI; NTIS; GPO Dep.

Requirements for effective safeguards during the transition to environmental management at nuclear material production facilities within the DOE complex are deriving improvements in the accuracy of nondestructive assay (NDA) techniques. An important aspect of the transition is the need for facilities to terminate safeguards on waste materials, thus reducing the cost for safeguards at the facility. Requirements for the termination of safeguards on candidate waste material have been established by DOE to minimize the potential for diversion or theft of nuclear material. Because heterogenous waste and residue materials are stored in large containers such as 208-L drums, conventional assay techniques such as segmented gamma scanning (SGS) that were developed to assay small samples cannot always provide accurate measurements. Consequently, facilities using the conventional NDA instrumentation may be limited in their ability to discard waste materials in compliance with DOE requirements. One technique being applied to improve the accuracy of assays of waste in large containers is computerized tomography (CT). Research on the application of CT to improve both neutron and gamma-ray assays of waste is being carried out at Los Alamos National Laboratory. For example, tomographic gamma scanning (TGS) is a single-photon emission CT technique that corrects for attenuation of gamma rays emitted from the sample using attenuation images from transmission CT.

21053 (LA-UR–95-1282) **Production of an English/Russian glossary of terminology for nuclear materials control and accounting.** Schachowskoj, S.; Smith, H.A. Jr. Los Alamos National Lab., NM (United States). [1995]. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010852. Source: OSTI; NTIS; INIS; GPO Dep.

The program plans for Former Soviet Union National Nuclear Materials Control and Accounting (MC and A) Systems Enhancements call for the development of an English/Russian Glossary of MC and A terminology. This glossary was envisioned as an outgrowth of the many interactions, training sessions, and other talking and writing exercises that would transpire in the course of carrying out these programs. This report summarizes the status of the production of this glossary, the most recent copy of which is attached to this report. The glossary contains over 950 terms and acronyms associated with nuclear material control and accounting for safeguards and nonproliferation. This document is organized as follows: English/Russian glossary of terms and acronyms; Russian/English glossary of terms and acronyms; English/Russian glossary of acronyms; and Russian/English glossary of acronyms.

21054 (LA-UR–95-1393) **SR (Shift Register) COLLECT users manual. Version 2.00.** Hansen, W.; Painter, J.A.; Augustson, R.H. Los Alamos National Lab., NM (United States). 19 Dec 1994. 37p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract W-7405-ENG-36. Order Number DE95012053. Source: OSTI; NTIS; GPO Dep.

SR COLLECT is intended to be used by International Energy Agency (IAEA) inspectors in facilities in Japan for remote unattended collection of data recorded by a shift register electronics unit. In addition, it will send a signal to a monitoring camera to record the occurrence of significant events. SR COLLECT organizes the collected data into a set of files that can be copied to floppy diskettes. The data copied to these diskettes can, in turn, be imported into the SR Review program for analysis. Unattended data collection requires a high degree of reliability. SR COLLECT is capable of restarting itself after loss of power to the collect computer. SR COLLECT is also capable of recovering from loss of communications with the shift electronics unit. Data is recorded in files on the hard disk immediately after it is collected. All significant events, called critical events, are recorded in a file. The set of parameters in effect is recorded in a file. Disk write caching is NOT used to prevent the loss of data caused by a sudden power failure.

21055 (PNL–D-410) **ADP Security Plan, Math Building, Room 1139.** Melton, R. Pacific Northwest Lab., Richland, WA (United States). 27 Aug 1985. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012633. Source: OSTI; NTIS; GPO Dep.

This document provides the draft copy of an updated (ADP) Security Plan for an IBM Personal Computer to be used in the Math Building at PNL for classified data base management. Using the equipment specified in this document and implementing the administrative and physical procedures as outlined will provide the secure environment necessary for this work to proceed.

21056 (SAND–95-1038) **Smart gun technology requirements preliminary report.** Weiss, D.R.; Brandt, D.J.; Tweet, K.D. Sandia National Labs., Albuquerque, NM (United States). May 1995. 68p. Sponsored by National Inst. of Law Enforcement and Criminal Justice, Washington, DC (United States). DOE Contract AC04-94AL85000. Contract IAA-94-IJ-R-021. Order Number DE95013886. Source: OSTI; NTIS; GPO Dep.

Goal of the Smart Gun Technology project is to eliminate the capability of an unauthorized user from firing a law enforcement officer's firearm by implementing user-recognizing-and-authorizing surety technologies. This project is funded by the National Institute of Justice. This document reports the projects first objective: to find and document the requirements for a user-recognizing-and-authorizing firearm technology that law enforcement officers will value. This report details the problem of firearm takeaways in law enforcement, the methodology used to develop the law enforcement officers' requirements, and the requirements themselves.

21057 (UCRL-ID–119970) **Decision model for evaluating reactor disposition of excess plutonium.** Edmunds, T. Lawrence Livermore National Lab., CA (United States). Feb 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011527. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy is currently considering a range of technologies for disposition of excess weapon plutonium. Use of plutonium fuel in fission reactors to generate spent fuel is one class of technology options. This report describes the inputs and results of decision analyses conducted to evaluate four evolutionary/advanced and three existing fission reactor designs for plutonium disposition. The evaluation incorporates multiple objectives or decision criteria, and accounts for uncertainty. The purpose of the study is to identify important and discriminating decision criteria, and to identify combinations of value judgments and assumptions that tend to favor one reactor design over another.

21058 (UCRL-ID–120749) **Plutonium-bearing materials feed report for the DOE Fissile Materials Disposition Program alternatives.** Brough, W.G. (Lawrence Livermore National Lab., CA (United States)); Boerigter, S.T. Lawrence Livermore National Lab., CA (United States). 6 Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011721. Source: OSTI; NTIS; INIS; GPO Dep.

This report has identified all plutonium currently excess to DOE Defense Programs under current planning assumptions. A number of material categories win clearly fan within the scope of the MD (Materials Disposition) program, but the fate of the other categories are unknown at the present time. MD planning requires that estimates be made of those materials likely to be considered for disposition actions so that bounding cases for the PEIS (Programmatic Environmental Impact Statement) can be determined and so that processing which may be required can be identified in considering the various alternatives. A systematic analysis of the various alternatives in reachmg the preferred alternative requires an understanding of the possible range of values which may be taken by the various categories of feed materials. One table identifies the current total inventories excess to Defense Program planning needs and represents the bounding total of Pu which may become part of the MD disposition effort for all materials, except site return weapons. The other categories, principally irradiated fuel, rich scrap, and lean scrap, are discussed. Another table summarizes the ranges and expected quantities of Pu which could become the responsibility of the MD program. These values are to be used for assessing the impact of the various alternatives and for scaling operations to assess PEIS impact. Determination of the actual materials to be included in the disposition program will be done later.

21059 (WSRC-MS–94-0575) **Plutonium Disposition Now!.** Buckner, M.R. Westinghouse Savannah River Co., Aiken, SC (United States). 24 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950919–1: ANS international conference on evaluation of emerging nuclear fuel cycle systems, Versailles (France), 11-14 Sep 1995). Order Number DE95060147. Source: OSTI; NTIS; INIS; GPO Dep.

A means for use of existing processing facilities and reactors for plutonium disposition is described which requires a minimum capital investment and allows rapid implementation. The scenario includes interim storage and processing under IAEA control, and fabrication into MOX fuel in existing or planned facilities in Europe for use in operating reactors in the two home countries. Conceptual studies indicate that existing Westinghouse four-loop designs can safety dispose of 0.94 MT of plutonium per calendar year. Thus, it would be possible to consume the expected US excess stockpile of about 50 MT in two to three units of this type, and it is highly likely that a comparable amount of the FSU excess plutonium could be deposed of in a few VVER-1000's. The only major capital project for this mode of plutonium disposition would be the weapons-grade plutonium processing which could be done in a dedicated international facility or using existing facilities in the US and FSU under IAEA control. This option offers the potential for quick implementation at a very low cost to the governments of the two countries.

0560 Legislation and Regulations

Refer also to citation(s) 20783, 20819, 20823, 20942, 21018, 21033, 21212, 21213, 21231, 21232, 22270, 22466

21060 (INIS-mf–14535) **The role of governmental and non-governmental organizations in developing and teaching radiation physics.** Gomaa, M.A.; Elnaggar, A.M. (eds.). Atomic Energy Establishment, Cairo (Egypt). 1994. 124p. (CONF-9311314–: 2. seminar on radiation physics, Cairo (Egypt), 20-21 Nov 1993). Order Number DE95631065. Source: OSTI; NTIS (US Sales Only); INIS.

This conference involves subjects of radiation physics, implementation of ICRP, egypt air radioactive sources and radon daughters measurement. it contains figures, tables and data.

21061 (NUREG/CR–0200-Vol.1-Rev.4) **SCALE: A modular code system for performing standardized computer analyses for licensing evaluation. Control modules – Volume 1, Revision 4.** Landers, N.F. (Oak Ridge National Lab., TN (United States)); Petrie, L.M.; Knight, J.R. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Oak Ridge National Lab., TN (United States). Apr 1995. 767p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NUREG/CSD–2/R4-Vol.1). Source: OSTI; NTIS; GPO; INIS.

SCALE–a modular code system for Standardized Computer Analyses Licensing Evaluation–has been developed by Oak Ridge National Laboratory at the request of the US Nuclear Regulatory Commission. The SCALE system utilizes well-established computer codes and methods within standard analysis sequences that (1) allow an input format designed for the occasional user and/or novice, (2) automate the data processing and coupling between modules, and (3) provide accurate and reliable results. System development has been directed at problem-dependent cross-section processing and analysis of criticality safety, shielding, heat transfer, and depletion/decay problems. Since the initial release of SCALE in 1980, the code system has been heavily used for evaluation of nuclear fuel facility and package designs. This revision documents Version 4.2 of the system. This manual is divided into three volumes: Volume 1–for the control module documentation, Volume 2–for the functional module documentation, and Volume 3 for the documentation of the data libraries and subroutine libraries.

21062 (NUREG/CR–0200-Vol.2-Pt.1-Rev.4) **SCALE: A modular code system for performing standardized computer analyses for licensing evaluation. Functional modules F1–F8 – Volume 2, Part 1, Revision 4.** Greene, N.M. (Oak Ridge National Lab., TN (United States)); Petrie, L.M.; Westfall, R.M.; Bucholz, J.A.; Hermann, O.W.; Fraley, S.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Oak Ridge National Lab., TN (United States). Apr 1995. 656p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NUREG/CSD–2/R4-Vol.2-Pt.1). Source: OSTI; NTIS; GPO; INIS.

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07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

Refer also to citation(s) 21846

21063 (LA–12944-MS) **Use of the Los Alamos Hot-Cell Facility for target fabrication and separation of molybdenum-99.** Field, L.; Ledbetter, J.; Knobeloch, D. Los Alamos National Lab., NM (United States). Apr 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010553. Source: OSTI; NTIS; GPO Dep.

Congress has tasked the Department of Energy (DOE) with developing a domestic source of the radioisotope molybdenum-99 (^{99}Mo) for use by the medical research community. At present, there are no commercial facilities in the United States that are capable of producing ^{99}Mo, and few DOE facilities have suitable reactor and hot-cell facilities for the extraction and purification of the isotopes. This report addresses the implementation of a limited-term ^{99}Mo production program at Los Alamos National Laboratory. We present our proposal for generating ^{99}Mo: the fabrication and processing of uranium targets at Los Alamos and the irradiation of targets at Sandia National Laboratories. Los Alamos already has a hot-cell facility that can be readily converted to the production of ^{99}Mo and other commercially important radioisotopes, such as iodine-131 and xenon-131. Because the ^{99}Mo production process will be combined into an already existing facility, the cost of developing this capability is much lower than any other alternative being considered by the DOE. In this report, we describe the ^{99}Mo production process, provide a cost analysis for converting the hot-cell facility, and outline the schedule necessary to implement this capability to meet current DOE plans. Also discussed in this report are issues related to the hot-cell operations, including waste management, the transportation of targets between Los Alamos and Sandia, and the shipment of ^{99}Mo to radiopharmaceutical companies.

21064 **Molecular separation method and apparatus.** Villa-Aleman, E. To Dept. of Energy. 1993. Filed date 6 Jan 1993. U.S. Patent Application 8-002,352. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95009954. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A method and apparatus are disclosed for separating a gaseous mixture of chemically identical but physically different molecules based on their polarities. The gaseous mixture of molecules is introduced in discrete quantities into the proximal end of a porous glass molecular. The molecular sieve is exposed to microwaves to excite the molecules to a higher energy state from a lower energy state, those having a higher dipole moment being excited more than those with a lower energy state. The temperature of the sieve kept cold by a flow of liquid nitrogen through a cooling jacket so that the heat generated by the molecules colliding with the material is transferred away from the material. The molecules thus alternate between a higher energy state and a lower one, with the portion of molecules having the higher dipole moment favored over the others. The former portion can then be extracted separately from the distal end of the molecular sieve.

0702 Radiation Sources

Refer also to citation(s) 21632, 22111

21065 (INCT–2157/7) **Technological yields of sources for radiation processing.** Zagorski, Z.P. (Institute of Nuclear Chemistry and Technology, Warsaw (Poland)). Institute of Nuclear Chemistry and Technology, Warsaw (Poland). 1993. 32p. (In Polish). Order Number DE95632412. Source: OSTI; NTIS; INIS.

2.edition (compiled and revided).

The present report is prepared for planners of radiation processing of any material. Calculations are focused on accelerators of electrons, divided into two groups: versatile linacs of energy up to 13 MeV, and accelerators of lower energy, below 2 MeV, of better energy yield but of limited applications. The calculations are connected with the confrontation of the author's technological expectations during the preparation of the linac project in the late '60s, with the results of 25 years of exploitation of the machine. One has to realize that from the 200 kW input power from the mains, only 5 kW of bent and scanned beam is recovered on the conveyor. That power is only partially used for radiation induced phenomena, because of the demanded homogeneity of the dose, of the mode of packing of the object and its shape, of edges of the scanned area and in the spaces between boxes, and of loses during the idle time due to the tuning of the machine and dosimetric operations. The use of lower energy accelerators may be more economical than that of linacs in case of objects of specific type. At the first stage already, that is of the conversion of electrical power into that of low energy electron beam, the yield is 2-3 times better than in the case of linacs. Attention has been paid to the technological aspects of electron beam conversion into the more penetrating Bremsstrahlung similar to gamma radiation. The advantages of technologies, which make possible a control of the shape of the processed object are stressed. Special attention is focused to the relation between the yield of processing and the ratio between the maximum to the minimum dose in the object under the irradiation. (author). 14 refs, 14 figs.

21066 (LA-UR–95-1486) **Quasi-optical gyrotron materials processing at Los Alamos.** Katz, J.D.; Rees, D.E. Los Alamos

National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950401–5: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95011994. Source: OSTI; NTIS; GPO Dep.

Los Alamos has recently obtained and installed quasi-optical gyrotrons of 37 and 84 GHz with power outputs up to 35 kW. A quasi-optical gyrotron is unique in that the output is a Gaussian beam which can be focused and manipulated using mirrors. The Gaussian beam output is ideally suited for one and two dimensional materials processing applications such as joining and surface treatment. Working with the National Center for Manufacturing Sciences (NCMS) we have formed a consortium of companies to investigate several materials processing applications.

0707 Regulation and Licensing

Refer also to citation(s) 21212

08 HYDROGEN

Refer also to citation(s) 21421

0801 Production

21067 (CONF-9504160–2) **Enzymatic production of hydrogen from glucose.** Woodward, J. (Oak Ridge National Lab., TN (United States)); Mattingly, S.M. Oak Ridge National Lab., TN (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1995 DOE/NREL hydrogen program review; Coral Gables, FL (United States); 18-21 Apr 1995. Order Number DE95012842. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to optimize conditions for the enzymatic production of hydrogen gas from biomass-derived glucose. This new project is funded at 0.5 PY level of effort for FY 1995. The rationale for the work is that cellulose is, potentially, a vast source of hydrogen and that enzymes offer a specific and efficient method for its extraction with minimal environmental impact. This work is related to the overall hydrogen program goal of technology development and validation. The approach is based on knowledge that glucose is oxidized by the $NADP^+$ requiring enzyme glucose dehydrogenase (GDH) and that the resulting NADPH can donate its electrons to hydrogenase (H_2ase) which catalyzes the evolution of H_2. Thus hydrogen production from glucose was achieved using calf liver GDH and Pyrococcus furiosus H_2ase yielding 17% of theoretical maximum expected. The cofactor $NADP^+$ for this reaction was regenerated and recycled. Current and future work includes understanding the rate limiting steps of this process and the stabilization/immobilization of the enzymes for long term hydrogen production. Cooperative interactions with the Universities of Georgia and Bath for obtaining thermally stable enzymes are underway.

21068 (DOE/GO/10039–2) **Solar powered hydrogen generating facility and hydrogen powered vehicle fleet. Technical progress report, October 1, 1994–December 31, 1994.** Provenzano, J.J. Clean Air Now, Santa Monica, CA (United States). Feb 1995. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC36-94GO10039. Order Number DE95009193. Source: OSTI; NTIS; GPO Dep.

The status of the project is updated.

21069 (DOE/GO/10039–T1) **Solar powered hydrogen generating facility and hydrogen powered vehicle fleet. Technical progress report, January 1, 1995–March 31, 1995.** Provenzano, J.J. Clean Air Now, Santa Monica, CA (United States). Project Office. Apr 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC36-94GO10039. Order Number DE95013838. Source: OSTI; NTIS; GPO Dep.

The project proceeded generally according to schedule, with most of the work directed at procurement of materials, initiation of equipment fabrication by contractors, and development of educational materials. The first vehicle retrofit was completed in March 1995, and prepared for delivery to DOE's Energy Technology Engineering Center.

0802 Storage, Transport, and Handling

21070 (LA-UR–95-1370) **Sn-substituted $LaNi_5$ alloys for metal hydride electrodes.** Wasz, M.L. (Los Alamos National Lab., NM (United States). Center for Materials Science); Schwarz, R.B.; Srinivasan, S.; Sridhar Kumar, M.P. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950412–10: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95012059. Source: OSTI; NTIS; GPO Dep.

This research examines the efficacy of tin additions to $LaNi_5$ in improving the hydrogen storage capacity of the material during charging/discharging. Alloys were prepared using high energy ball milling (mechanical alloying), a technique superior to arc casting for alloying elements with a wide disparity in melting points. Characterization by X-ray diffraction and Rietveld analysis shows that tin preferentially occupies the Ni(3g) sites in the $LaNi_5$ structure, and the unit cell volume increases linearly with tin content to the maximum tin solubility of 7.33 atomic percent ($LaNi_{4.56}Sn_{0.44}$). The authors found that powders prepared by mechanical alloying and not exposed to air require no activation to induce hydrogen absorption. The hydrogen storage capacity in the gas and electrochemical phase was measured as a function of tin content. They found that with increasing tin, the plateau pressure decreases logarithmically, whereas the hydrogen storage capacity decreases linearly.

0830 Combustion

Refer also to citation(s) 21531, 21538

09 BIOMASS FUELS

21071 (NEDO-P–9311) **Feasibility study on introducing the bio-fueled power generation. 2.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 178p. (In Japanese). Order Number DE95786805. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

With relation to bagasse as biomass resource, surplus power and economic efficiency were examined when producing electric power from bagasse in case of changing the purpose of using bagasse in sugar manufacturing plants from steam as main product/power as secondary product to power as main/steam as secondary. Surplus power in the sugar manufacturing plant is made salable to the commercial power system. In the trial design, it is clarified that in case of a sugar manufacturing plant processing sugarcane of 1,000 tons/day, the existing power generation capacity, 1,140 kW, increases by approximately three times to 3,340 kW at maximum. Judging from the worldwide annual bagasse production of 1.65 million tons against the annual cane sugar production of 75.033 million tons, the worldwide potential power generation capacity to be brought by the system will actually be 7.68 million kW even if steam needed for processing in the sugar manufacturing plant is surely obtained from bagasse. If aged boiler facilities of sugar manufacturing plants in the world' main sugar producing countries are renewed in this design idea, effects of the system will be immeasurably enormous. 42 figs., 55 tabs.

0908 Production

21072 (CONF-9411229–1) **Bioenergy: What's in it for the grower? The cost of producing dedicated energy crops. Comparisons with conventional crops.** Walsh, M. Oak Ridge National Lab., TN (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Preparing for rural energy and economic development; Knoxville, TN (United States); 9-10 Nov 1994. Order Number DE95012880. Source: OSTI; NTIS; GPO Dep.

Dedicated energy crops must be at least as profitable as conventional crops that could be grown on a given site before farmers will produce energy crops on that site. This report concentrates on the cost of producing dedicated energy crops and compare those costs to the profitability of conventional crops. This comparison allows one to estimate a breakeven price, that is, a price for which the profitability of dedicated energy crops is equivalent to the profitability of conventional crops. Switchgrass and hybrid poplar have been chosen as representative herbaceous and woody crop species for the estimation.

21073 (DOE/NV/11432–T6) **Performance of stem flow gauges in greenhouse and desert environments.** Levitt, D.G. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)); Simpson, J.R.; Tipton, J.L. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). [1995]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-94NV11432. Order Number DE95013095. Source: OSTI; NTIS; GPO Dep.

This study was conducted to evaluate the accuracy and general performance of a heat balance method for estimating transpirational sap flow through plant stems on two tree species in greenhouse and field experiments in Tucson, Arizona. Sap flow through 20-mm diameter stems of oak (Quercus virginiana 'Heritage') and mesquite (Prosopis alba 'Colorado'.) trees in containers was measured using stem flow gauges and a precision balance, from January to October, 1991. Overall gauge accuracy, and the effects of gauge location on the tree stem, gauge ventilation, gauge insulation, sheath conductance factor (Ksh) selection method, and increased numbers of vertical thermocouple pairs on gauge performance were evaluated.

0909 Processing

Refer also to citation(s) 20570, 21067, 21100

21074 (DOE/CE/40905–57) **Development of a prototype lignin concentration sensor. Final report.** Jeffers, L.A. Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div. Nov 1994. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC05-90CE40905. Order Number DE95010951. Source: OSTI; NTIS; GPO Dep.

The workscope covered in this report is the first step toward the development of an instrument for the on-line measurement of lignin concentration in wood pulp. This first-step program consisted of a series of laboratory measurements of the fluorescence spectra of well-defined pulp samples. The objective of the program was to develop the data base necessary to design a field-testable prototype instrument, to define the range of conditions over which the prototype can be expected to provide satisfactory performance, and to provide the background for interpretation of the results obtained when field testing the prototype.

21075 (DOE/GO–10095-089) **Biomass Power: Program overview fiscal years 1993–1994.** National Renewable Energy Lab., Golden, CO (United States). Mar 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94000241. Source: OSTI; NTIS; GPO Dep.

The Biomass Power Program and industry are developing technologies to expand the use of biomass that include methods of feedstock production and the equipment to convert feedstocks into electric power or process heat. With the help of advanced biomass power technologies and new feedstock supply systems, as much as 50,000 megawatts (MW) of biomass power capacity will be in place by the year 2010. The Biomass Power Program supports the development of three technologies–gasification, pyrolysis, and direct combustion–from the laboratory bench scale to the prototype commercial scale. Gasification equipment produces biogas that is burned in high-efficiency turbine-generators developed for the electric power industry. Pyrolysis processes produce oils from renewable biomass that burn like petroleum to generate electricity. In direct combustion technology, power plants today burn bulk biomass directly to generate electricity. Improving the direct combustion technology of these plants increases efficiency and reduces emissions. In addition to developing these three technologies, the Biomass Power Program supports joint ventures to plan and construct facilities that demonstrate the benefits of biomass power. The Program is supporting joint ventures to conduct 10 case studies of dedicated feedstock supply systems.

21076 (DOE/GO–10095-166) **Biomass power: An old resource for a new technology.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004081. Source: OSTI; NTIS; GPO Dep.

As many as 50,000 MW of electricity could be generated by biomass power plants in the year 2010 with advanced technologies and improved feedstock supplies. This pamphlet describes the current status and capacity of biomass power plants in the US, advanced technologies under development, a way to guarantee a dedicated fuel supply, and sources for further information.

21077 (ETDE-DE–124) **Transverse flow micro-filtration with vibrating modules to retain biomass on woven materials. Final report.** Dortmund Univ. (Germany). Fachbereich Chemietechnik. 29 Jan 1993. 26p. (In German). Sponsored by Arbeitsgemeinschaft Industrieller Forschungsvereinigungen e.V., Koeln (Germany). Contract AIF 8042. Order Number DE95780303. Source: OSTI; NTIS (US Sales Only).

To increase the spatial/temporal yield in bio-technological fermentation, continuous transverse flow micro-filtration is available among the filtration processes. The times of use of filter materials were examined by applying mechanical vibrations in the range of 10 to 120 Hz. It was found that the vibration-supported filtration only showed an increase of the filtration flow in purely toplayer controlled systems. Blocking of the pores of a filter material could not be prevented by the effect of vibration. The twisted weaves examined did not show the required degrees of separation for biological suspensions. (BBR)

21078 (ETDE-DE–142) **New supporting materials for cell immobilisation. Final report.** Technische Hochschule Koethen (Germany). Inst. fuer Biologie und Biochemie. [1993]. 9p. (In German). Sponsored by Arbeitsgemeinschaft Industrieller Forschungsvereinigungen e.V., Koeln (Germany). Contract AIF 42D. Order Number DE95786064. Source: OSTI; NTIS (US Sales Only).

As an alternative to the commonly used yrast-immobilising matrices of ionotrope polysaccharide gel (e.g. Ca alginate) we used 1-1.5 mm spherical, depigmented, delipidated specimen of the duckweed Wolffia arrhiza. Fermentation was conducted in a fluidised-bed bioreactor according to the procedural principles of fluidised bed reactors. Progressively larger quantities starting from 0.1 l to 6.5, 9 and then 10 l posed no problems. Volumetric productivities of P = 55-65 g ethanol/l.h were obtained using saccharose (140 g/l) as a substrate, immobilised baker's yeast (saccharomyces cerevisiae), a dilution rate of 0.75-1.3 h^{-1} and a biomass fraction of approx. 80 g HTS/l support. The system is suitable for long-time fermentation (tested for up to 200 days). (orig./EF)

21079 (GSF–01/95) **Energy from renewable raw materials. Seminar materials of Zentrale Informationsstelle Umweltberatung Bayern. Vol. 5.** Kohmanns, B. (comp.); Littmann, A. (comp.); Haury, H.J. (comp.). GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Jan 1995. 76p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9409350–: 4. seminar of Zentrale Informationsstelle Umweltberatung Bayern: Energy from renewable raw materials, Nuernberg (Germany), 22 Sep 1994). Order Number DE95779579. Source: OSTI; NTIS (US Sales Only).

The potential of energy production from biomass is reviewed, including environmental effects and aspects of environmental policy. The processes of vegeteable oil production are reviewed, as well as its applications and environmental impact. The process of biogas production by means of anaerobic digestion of waste is described, and a performance report is given for a bark-fuelled heating power station. (orig.)

21080 (NREL/SP–420-7849) **Seventeenth symposium on biotechnology for fuels and chemicals. Program and abstracts.** National Renewable Energy Lab., Golden, CO (United States). [1995]. 206p. Sponsored by USDOE, Washington, DC (United States);National Renewable Energy Lab., Golden, CO (United States);Oak Ridge National Lab., TN (United States);Argonne National Lab., IL (United States);American Cancer Society, New York, NY (United States);Natio DOE Contract AC36-83CH10093. (CONF-950587–Absts.: 17. symposium on biotechnology for fuels and chemicals, Vail, CO (United States), 7-11 May 1995). Order Number DE95004054. Source: OSTI; NTIS; GPO Dep.

This volume contains the abstracts of oral and poster presentations made at the Seventeenth Symposium on Biotechnology for Fuels and Chemicals. Session titles include Thermal, Chemical, and Biological Processing; Applied Biological Research; Bioprocessing Research; Special Topics Discussion Groups; Process Economics and Commercialization; and Environmental Biotechnology.

0910 Properties and Composition

21081 (NEI-DK–2010) **Combustion of polluted waste wood. Investigation of environmentally pollutive substances issuing from waste incineration plants with or without the addition of polluted waste wood to the volume of waste.** Energiministeriets Forskningsudvalg for produktion og fordeling af el og varme. Braendsler og forbraendingsteknik. Terkildsen, L. Dk-Teknik, Soeborg (Denmark). Dec 1994. 128p. (In Danish). Contract ENS-1323/91-0020. Order Number DE95779221. Source: OSTI; NTIS.

EFP-91.

Waste wood which has been used for outdoor constructions is often impregnated with protective substances such as coal tar, arsenic, copper, chromium and/or pentachlorophenol. Currently in Denmark this kind of waste wood must be brought to a special depot. It is suggested that it would be better to burn it so that it could be used to produce energy (this would also save time and money otherwise used on sorting processes) but the environment must be protected from the resulting pollutive and poisonous emission. It has been calculated that by 2015 there will be 400.000 tons of this kind of impregnated waste wood, taken from torn-down buildings in Denmark, which could make up 4-5% of total fuel consumption. The aim of the project was to discover whether it would be possible to use polluted waste wood as fuel for the production of electricity and heating in a non-pollutive way. Investigations were carried out on the combustion of waste woods at a Danish waste incineration plant. Results are presented in detail. It was found that copper almost always ran out into the slag, that chromium, manganese and nickel usually ran out into the slag, that cadmium was almost always found in the waste product, that arsenic and lead usually ended in the waste product and that mercury was most often found in the flue gas. There was an increased risk of the formation of dioxins. It was also found that if the moisture content of the waste wood was ca. 25% (the same as ordinary waste) it would be possible to add ca. 14 w/w % of wood to the wastes to be incinerated and still retain optimal combustion. (AB) (17 refs.)

21082 (NEI-DK–2011) **Combustion of polluted waste wood. Phase 1: Report on literature.** Energiministeriets Forskningsudvalg for produktion og fordeling af el og varme. Braendsler og forbraendingsteknik. Terkildsen, L. Dk-TEKNIK, Soeborg (Denmark). Energi og Miljoe. Dec 1994. 90p. (In Danish). Contract ENS-1323/91-0020. Order Number DE95779220. Source: OSTI; NTIS.

EFP-91.

The document supplements another of the same, main, title. It gives the results of a survey of literature relevant to the subject of the feasibility of using impregnated waste wood, that has previously been used in buildings, as fuel for producing electricity and heating. (AB) (39 refs.)

0920 Combustion

Refer also to citation(s) 20595, 21075, 21081, 21082

21083 (NEI-DK–1997) **Advanced control system for a solid fuel combustion plant.** Energiministeriets Forskningsudvalg for produktion og fordeling af el og varme. Braendsler og forbraendingsteknik. Cramer, J. Dk-TEKNIK, Soeborg (Denmark). Energi og Miljoe. Mar 1995. 156p. (In Danish). Contract ENS-1323/89-19. Order Number DE95779165. Source: OSTI; NTIS.

EFP-89.

The project has developed a vision system for the combustion on a Voelund 'cigar-burner' (straw combustion) on the Haslev cogeneration plant. The system has been connected to the process control system of the power plant and can prevent the formation of projecting unburned areas on the burning bale. The system is configurable and can be adapted to other geometries and combustion processes. A rugged and compact camera house and flange system for monitoring of combustion processes has been developed. The best supervision of the combustion processes, is obtained with a fast shutter speed infra-red CCD camera. The project has been accomplished in five phases: the development of a rugged monitoring system for the straw fired 'cigar burners' at Haslev cogeneration plant, trials with video recordings of relevant combustion patterns, the development of a realtime computer program for analysis of video pictures of relevant situations of the burners, testing of picture analysis program at Haslev co-generation plant and testing the entire vision system. The stickiness of the straw ashes is decisive for the cooling conditions around the camera housing. The vision system developed could soon detect the formation of unburned, advanced regions on the 'cigar burner'. Through an automatic change of the feed rate the burner was brought back to the optimal combustion pattern. The installation of video monitoring or computer vision on plants with combustion of solid fuels, can optimize the combustion process and prevent shut-downs. dk-TEKNIK has also tested the video monitoring system at several combustion plants burning different kinds of biomass. (AB)

21084 (NEI-DK–2000) **Testing of the superheater materials for waste and biofuel boiler systems.** Energiministeriets Forskningsudvalg for produktion og fordeling af el og varme. Braendsler og forbraendingsteknik. Teilslev, B. (Voelund R and D Center (Denmark)); Nielsen, V.; Jansen, P.; Andersen, F.; Gotthjaelp, K.; Broendsted, P. Risoe National Lab., Roskilde (Denmark). Materials Dept. Apr 1995. 92p. (In Danish). Contract ENS-1323/93-0012. Order Number DE95779200. Source: OSTI; NTIS.

EFP-93.

In the EFP93- project 'Testing of superheater materials for refuse- or biofuel fueled boilers' various prospective overheater materials were tested in order to determine conditions for achievement of improved steam parameters in biomass-fueled boilers. Overheater materials were exposed as a corrosion probe to flue gas action in a temperature range from 475 to 575 deg.C. Flue gas was produced by combustion of wastes or straw in the boiler. In these conditions Ni-Cr alloy steels were proved to have lower corrosion rate then the low alloy steel 15Mo3. The Ni-Cr alloys generally have the same resistance, and no correlation between corrosion and Ni+Cr contents was observed. Compared to Ni-Cr alloy steels, the Ni Alloy 625 shows the best corrosion rate. Differences in the flue gas composition and temperature cause essential differences in corrosive losses, depending on various boiler- and fuel types. Flue gas from waste incineration was found to be far more corrosive than flue gas from straw combustion. However the respective corrosive properties within the same group of alloys remain the same irrespective of differences in exposure environment. (EG)

21085 (NEI-DK–2016) **Cleaning flue gas from smaller straw-fired boilers by using electric filters. Sub-report, phase 1. Collecting information.** Nielsen, C. Dk-TEKNIK, Soeborg (Denmark). Energi og Miljoe. Jan 1995. 139p. (In Danish). Contract ENS-51161-94.0032. Order Number DE95779212. Source: OSTI; NTIS.

Electric filters can be used for cleaning flue gas from straw-fuelled heating plants established on farms. The technique is explained. The sub-project aims at collecting information on this subject. No literature on electric filters used on small straw-fired heating plants was found. The four plants in Denmark that utilized these filters declared them satisfactory when flue gas temperature is under 130 grades, and emission was not more that 40-50 mg/

m^3,n. One firm in Germany and one in Austria manufactures electric filters suitable for small straw-fired heating plants located on farms. Technical details of these filters, and the names of the two firms are given. It is the aim of the main project to develop an electric filter for the purpose described above, and to prove that its use will reduce the emission of dusts etc. from straw-fuelled plants in accordance with Danish environmental demands. (AB)

21086 (NEI-NO–569) **Nordic seminar on biomass gasification and combustion.** Nordisk Ministerraad. 1993. 322p. (In English, Swedish). (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The report comprises a collection of papers from a seminar arranged as a part of the Nordic Energy Research Program. The aim of this program is to strengthen the basic competence in the energy field at universities and research organizations in the Nordic countries. In the program 1991-1994 six areas are selected for cooperation such as energy and society, solid fuels, district heating, petroleum technology, bioenergy and environment, and fuel cells. The topics deal both with biomass combustion and gasification, and combustion of municipal solid waste (MSW) and refuse derived fuel (RDF). A number of 11 papers are prepared. 97 refs., 91 figs., 11 tabs.

21087 (NEI-NO–569, pp. 61-77) **Formation and reduction of nitric oxides from fixed bed combustion of wood.** Keller, R. (Swiss Federal Inst. of Technology, Zuerich (Switzerland)). Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

Nitric oxides (NO) from wood combustions originate mainly from the nitrogen contained in the wood. The goal of this work is to minimize the NO formation during the staged combustion of wood. For this study a special 25 kW test reactor which consists of the fixed bed gasification chamber, the reduction chamber and the combustion chamber was built. Concentrations of carbon, hydrogen and nitrogen in particle along the axis of the fixed bed and the distribution of the fuel nitrogen on gasification gases were determined. Under optimized staged combustion conditions with a heated reduction chamber and a residence time of 0.5 s NO_2 emissions from wood combustion were reduced from 200 mg/m^3 (at 11% O_2) to 93 mg/m^3. With multiple staged combustion of wood NO_2 emissions of 74 mg/m^3 can be achieved. 11 refs., 14 figs.

21088 (NEI-NO–569, pp. 159-186) **A computer model for surface combustion of straw bales.** Bech, N. (Risoe National Lab., Roskilde (Denmark)). Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The present paper describes a computer model for the calculation of the steady and non-steady behaviour of surface combusting straw bales. The mathematical formulation is one-dimensional and the flow of gas through the straw bales is described by means of Darcy's law for flow through a porous medium. The model treats important phenomena such as evaporation, condensation and diffusion of water, pyrolysis of straw, combustion of gas, combustion of straw char, thermal radiation, heat conduction in the straw, and straw-gas heat transfer. The straw bale properties such as porosity, permeability and water content may vary with time and the location in the bale. Numerical experiments show that the results obtained with the model exhibit trends similar to those that would be expected and which have been observed in preliminary experiments. 7 refs., 6 figs.

21089 (NEI-NO–569, pp. 187-199) **Modelling of black liquor pyrolysis.** Saastamoinen, J. (Technical Research Centre of Finland. Combustion and Thermal Engineering Lab., Jyvaeskylae (Finland)). Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The paper describes a mathematical model for pyrolysis of black liquor droplets in high temperature atmosphere. Black liquor as a fuel has similarities to different liquid fuels as heavy fuel oil droplet, multicomponent liquid fuel and coal water slurry. Models for heavy fuel oil, coal water slurry and multicomponent liquid fuel vaporization and pyrolysis have been presented. The black liquor droplets contain a great amount of water and the drying and pyrolysis occurs partly simultaneously according to calculations based on the present model even when the droplet size is small. The black liquor droplets swell significantly during drying and pyrolysis. The droplet volume increases to a size about 30 times the original size. The model presented here is based on a previous model used for wood particle pyrolysis. The combustion properties of black liquor have recently been studied. 7 refs., 5 figs., 1 tab.

21090 (SH-IR–1995-50) **Optimization of combustion in smaller straw-fired boilers. Testing of HZT oxygen control.** Kristensen, J.K. (Forskningscenter Bygholm, Afd. for Jordbrugsteknik, Sektion for Maskinteknik (Denmark)); Heide Joergensen, M. Statens Husdyrbrugsforsoeg, Copenhagen (Denmark). May 1995. 18p. (In Danish). Contract ENS-51161-94.0032. Order Number DE95779211. Source: OSTI; NTIS.

A system (originated by Hans Z. Thellesen. (HZT)) which measures the content of oxygen in smoke from burning straw, and which following regulates the stoking of the straw in accordance with the air volume, is tested. The control system incorporates an oxygen probe, ('Lambda Sonde' manufactured by Bosch) which, via a frequency module, is connected to a computer programme. It was found efficient in stabilizing the combustion of the straw by stoking-dosage regulation in relation to the content of oxygen in the smoke. There was also a slight improvement of boiler efficiency, but emission of carbon monoxide and dust remained the same when using this system. Because of variations in the quality of the straw fuelled, it is normally necessary to continually adjust a combustion system, and this is why the HZT system is particularly useful, both in making such constant adjustments unnecessary and by the fact that it conduces stable combustion which, in its turn, produces less air pollutants. If the oxygen sensor registers carbon monoxide the system sends more oxygen into the flue gas, and this normally reduces the content of carbon monoxide. By the use of this system, energy consumption for the operation of the electric motors is reduced by 20%. The HZT system is robust and needs no maintenance. Registration by the oxygen sensor is not influenced by variations in flue gas temperature or by condensation in the flue gas outlet at shutdown. (AB)

0950 Environmental Aspects

21091 (NEI-DK–2015) **Development of air-treatment plant Linkogas 1993.** Linkogas AmbA, Lintrup (Denmark). Sep 1994. 16p. (In Danish). Contract ENS-51161-93.0072. Order Number DE95779210. Source: OSTI; NTIS; INIS.

One of the first larger biomass conversion plants built in South Jutland, Denmark (1990) was designed to take 300 tons of animal manure and 60 tons of industrial waste per 24 hrs. The bio air-filter proved unsatisfactory and neighbours complained of a very unpleasant smell. Other methods of air cleaning were also tried out with little success, and the plant was threatened with closure. Finally the air extraction system was totally retrofitted. The new extractor sucked air from the tanks (the pressure was held at 0 - minus 1 mm Vs). The extracted air was used up in the boiler, and combustion here was continual. If the combustion should discontinue the extracted air is lead through the bio- and coal-fiber filters. The conversion and design are described. There have since been only one or two complaints about unpleasant odour, and these

problems have been dealt with by ordinary servicing and/or detection and closing of leaks. (AB)

21092 (NEI-DK–2032) **Gasification versus combustion of solid wastes. Environmental aspects. Main report.** Stenholm, M. (ed.); Dalager, S.; Kristensen, O. Dk-TEKNIK, Soeborg (Denmark). Energi og Miljoe; Voelund R og D Center, Kolding (Denmark); Dansk Teknologisk Inst., Taastrup (Denmark). Apr 1994. 93p. (In Danish). Order Number DE95787770. Source: OSTI; NTIS; INIS.

The project covers the three main areas of fuel (a designation for that part of the total volume of Danish solid waste that is not reused and could thus be utilized as fuel for energy production) waste combustion and gasification of wastes. The expected volume and nature of solid wastes in Denmark up to 2000 is described and the wastes' suitability for gasification is evaluated. Investigations were undertaken of plants for gasification and pyrolysis of biomass in Europe, USA and Canada in order to evaluate technology development there, especially with regard to the use of wastes as fuel. The processes were compared. It was concluded that combustion had the advantage as no commercial waste gasification plants were found in connection with this investigation. Commercial two-stage combustion was examined in USA and Canada. This can compete with combustion plants on the question of price and emission. The authors still consider that gasification, dependent on the extent of financial resources available, could be an important alternative to combustion. (AB) 12 refs.

21093 (NEI-DK–2033) **Gasification versus combustion of solid wastes. Environmental aspects. Supplementary report.** Stenholm, M. (ed.); Dalager, S.; Kristensen, O. Dk-TEKNIK, Soeborg (Denmark). Energi og Miljoe; Voelund R og D Center, Kolding (Denmark); Dansk Teknologisk Inst., Taastrup (Denmark). Apr 1994. 89p. (In Danish). Order Number DE95787771. Source: OSTI; NTIS; INIS.

The report is supplementary to the main one of the same title and contains detailed descriptions of the plants for gasification and pyrolysis of biomass visited in Europe, Canada and USA in order to evaluate the technology development, especially with regard to the use of solid wastes as fuel. (AB)

21094 (NEI-DK–2034) **Ashes from straw and wood-chip fired plants for agricultural usage. Pilot project.** Morsing, M. (Forskningscentret for Skov og Landskab (Denmark)); Westborg, S. Forskningscentret for Skov og Landskab, Lyngby (Denmark). Aug 1994. 44p. (In Danish). Contract ENS-51161-94.0006. Order Number DE95787767. Source: OSTI; NTIS; INIS.

The content of nutrients and heavy metals in ashes from the combustion of straw and wood chips at district heating plants is studied, on the basis of results of analyses from Danish municipalities, to determine whether such ashes are suitable for use as fertilizers. Results of the analysis of ashes from 9 wood-chip fired and 26 straw-fired plants are presented. They show significant variations in nutrient and heavy metal content which could be caused by combustion and operational conditions and/or testing methods. On condition that the phosphorous content of straw and wood-chip ashes amount to 1% of the dry matter, 50%-75% of the straw ashes and under 50% of wood chip ashes analyses are within the limit for cadmium stipulated in the Danish Ministry of the Environment's Executive Order no. 736 on the use of wastes for agricultural purposes. This is found to be unsatisfactory. It is suggested that a closer investigation should be undertaken in order to determine which amount of straw and wood-chip ashes can be accepted for use as fertilizers in consideration of the stipulated limits for cadmium content of wastes to be used for agricultural purposes. In addition the technological and economic potentials of dosing of these ashes for this use should be investigated. Fly ash and slag were also included in the analysis results studied and it was found that the cadmium content of slag did not prevent its use as fertilizer, but that the distribution of cadmium in slag, in fly ash and in slam from flue gas cleaning systems related to the combustion of wood chips should be further investigated. (AB)

21095 (NEI-NO–569, pp. 81-87) **Greenhouse gas emissions from wood stoves.** Karlsvik, E. (Norwegian Inst. of Technology. Foundation for Scientific and Industrial Research (Norway)); Hustad, J.E.; Skreiberg, Oe.; Soenju, O.K. Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS; INIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The present paper deals with the use of biomass for energy in Scandinavia. It accounts for 127 TWh (457 PJ) which is 9% of the total energy consumption. Combustion of biomass is CO_2-neutral in the greenhouse effect balance. However, emissions of NO_x, N_2O, CO and CH_4 contribute either direct or indirect to the greenhouse effect. Experiments have been performed in three different wood stove units, a traditional stove and two new stoves. The two new stoves consist of a staged combustion unit and a catalytic stove. The emissions of NO_x, N_2O, CO and UHC in addition to O_2 and CO_2 are measured with continuous analyzers. The emissions of NO_x tend to decrease (in ppm) during the combustion cycle, while the emissions during the combustion cycle in g/kg wood increase in the charcoal phase compared to the pyrolysis phase. The average NO_x emissions are higher for the catalytic stove than for the staged stove, but the average CO and UHC emissions are lower. The emissions of N_2O are in general low, below 10 ppm. The total emissions of greenhouse gases for different wood stoves are calculated and compared to oil combustion. 9 refs., 12 figs., 1 tab.

21096 (NEI-NO–569, pp. 89-114) **Emissions from RDF combustion.** Rosvold, H. (Stiftelsen for Industriell og Teknisk Forskning (SINTEF). Applied Thermodynamics, Trondheim (Norway)). Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS; INIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The paper deals with the emissions from refuse derived fuel (RDF) combustion. The disposal of refuse has during the last years been a matter of increasing concern for many municipalities. The environment options for waste disposal has not been focusing much. This means that first the waste generation must be reduced. Then recycling of a portion of the waste must be considered before a solution with combustion of waste is chosen. Two methods are currently in use for the combustion of municipal solid waste (MSW) which are the mass burning of unprocessed MSW and RDF. The RDF product consists of the burnable organic fraction of raw MSW. In contrast to mass burning systems, the RDF-system is pre-processing the raw MSW to make a more homogeneous fuel product. By processing the MSW, it is possible to recover RDF and other materials. The RDF process is a low cost approach to resource recovery. RDF is a merchant fuel, and can be used in existing boilers alone or as a supplement to conventional fuels as oil and coal. It is important that the RDF processing technology and RDF quality matches the energy user requirements. The RDF-processing-systems is of great importance to the RDF quality. The paper shows the different steps in the RDF process. 4 refs., 15 figs.

21097 (NEI-NO–569, pp. 115-131) **Influence of aerodynamics on combustion efficiency and NO_x emission.** Collin, R. Nordisk Ministerraad. 1993. (In Swedish). (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS; INIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The paper deals with the improvement of combustion techniques in order to minimize the emission of NO_x from biomass-fuelled ovens and boilers. Four methods are referred to covering stepwise air-adding, recycling of exhaust gases, stepwise adding of fuel, and finally the injection of ammonia or urea etc. The injection method reduces NO to N_2. The verification of model tests and mathematical modelling are discussed in connection with two industrial projects on waste combustion using the methods of recycling and urea injection. 2 refs., 13 figs.

21098 (NEI-NO–569, pp. 133-144) **Pressurized biomass combustion with respect of wood fuel.** Jaanu, K. (Technical Research Centre of Finland. Combustion and Thermal Engineering Lab., Jyvaeskylae (Finland)); Orjala, M. Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS; INIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The paper deals with a research project investigating the reactivities of three different wood fuels, particle size less than 500 microns in a pressurized entrained flow reactor. The major issues have been the combustion efficiency related to unburned carbon, risk of slagging, alkali balance, and the reduction of gaseous emissions like CO, NO_x and SO_2 from gas turbines by varying the temperature and pressure level. 8 refs., 13 figs., 2 tabs.

21099 (NEI-NO–569, pp. 201-229) **Emissions from small scale biofuel combustion. Research needs.** Gustavsson, L. (Statens Provningsanstalt (Sweden)); Karlsson, M.L.; Larfeldt, J.; Leckner, B. Nordisk Ministerraad. 1993. (In Swedish). (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS; INIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The paper deals with the exhaust gas emission from small-sized boilers or cylindrical iron stoves. The biomass-fuelled boilers and stoves are designed for district heating or space heating. The boilers, which are equipped with ceramic lining or water cooling systems, have an output of up to 10 MW. The required limits of tar emissions are to be 30 mg/MJ and 40 mg/MJ for the boilers and stoves respectively. The paper discusses the demand of further improvements in minimizing the emission of volatile organic compounds (VOC) and NO_x. 15 refs., 11 figs., 1 tab.

21100 (NREL/TP–433-7867) **Environmental impacts of thermochemical biomass conversion. Final report.** Elliott, D.C. (Pacific Northwest Lab., Richland, WA (United States)); Hart, T.R.; Neuenschwander, G.G.; McKinney, M.D.; Norton, M.V.; Abrams, C.W. National Renewable Energy Lab., Golden, CO (United States); Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009210. Source: OSTI; NTIS; INIS; GPO Dep.

Thermochemical conversion in this study is limited to fast pyrolysis, upgrading of fast pyrolysis oils, and gasification. Environmental impacts of all types were considered within the project, but primary emphasis was on discharges to the land, air, and water during and after the conversion processes. The project discussed here is divided into five task areas: (1) pyrolysis oil analysis; (2) hydrotreating of pyrolysis oil; (3) gas treatment systems for effluent minimization; (4) strategic analysis of regulatory requirements; and (5) support of the IEA Environmental Systems Activity. The pyrolysis oil task was aimed at understanding the oil contaminants and potential means for their removal. The hydrotreating task was undertaken to better define one potential means for both improving the quality of the oil but also removing contaminants from the oil. Within Task 3, analyses were done to evaluate the results of gasification product treatment systems. Task 4 was a review and collection of regulatory requirements which would be applicable to the subject processes. The IEA support task included input to and participation in the IEA Bioenergy activity which directly relates to the project subject. Each of these tasks is described along with the results. Conclusions and recommendations from the overall project are given.

0970 Legislation and Regulations

Refer also to citation(s) 21100

0990 Products and By-Products

Refer also to citation(s) 21094

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 20542, 20543, 20544, 20545, 20546, 20547, 21393

21101 (ANL/ET/CP–84639) **Mixed-conducting ceramic membranes for partial oxygenation of methane.** Balachandran, U. (Argonne National Lab., IL (United States)); Dusek, J.T.; Maiya, P.S.; Mieville, R.L.; Kleefisch, M.S.; Udovich, C.A.; Bose, A.C. Argonne National Lab., IL (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950401–9: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013375. Source: OSTI; NTIS; GPO Dep.

The most significant cost associated with the conventional partial oxidation of methane is that of an oxygen plant. Our new technology offers a way to lower this cost, and in this paper we explore the technology that is based on dense ceramic membranes and that uses air as the oxidant for methane-conversion reactions. Mixed-conducting ceramic materials have been produced from mixed-oxide systems of the La-Sr-Fe-Co-O (SFC) type, in the form of tubes and bars. Thermodynamic stability of the tubes was studied as a function of oxygen partial pressure by high-temperature XRD. Mechanical properties were measured and found to be adequate for a reactor in the case of SFC-2: Electronic and ionic conductivities were measured; SFC-2 is unique in the sense that the ratio of ionic to electronic conductance is close to unity. Performance of the membrane tubes was good only with SFC-2. Fracture of other SFC tubes was the consequence of an oxygen gradient that introduced a volumetric lattice difference between the inner and outer walls. SFC-2 tubes provided methane conversion efficiencies of >99% in a reactor. These tubes have operated for >1000 h.

21102 (DOE/MC–00098-95/C0463) **Steady-state and transient catalytic oxidation and coupling of methane.** Iglesia, E.; Perry, D.L.; Heinemann, H. Lawrence Berkeley Lab., CA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950494–21: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012321. Source: OSTI; NTIS; GPO Dep.

This project addresses the conversion of methane from natural gas into ethane, ethylene and higher hydrocarbons. Our research explores the mechanistic and practical implications of carrying out the methane oxidative coupling reaction in reactor designs other than conventional packed-beds with co-fed reactants. These alternate reactor designs are needed to prevent the full oxidation of methane, which limits C_2, yields in methane oxidative coupling reactions. The research strategy focuses on preventing contact between the 0_2 reactant required for favorable overall thermodynamics and the C_{2+} products of methane coupling. The behavior of various reactor designs are simulated using detailed kinetic transport models. These simulations have suggested that the best way to prevent high CO_2 yields is to separate the oxygen and hydrocarbon streams altogether. As a result, the project has focused on the experimental demonstration of proton transport membrane reactors for the selective conversion of methane into higher hydrocarbons.

21103 (DOE/MC–26029-95/C0461) **Catalytic conversion of light alkanes: Proof of concept stage.** Lyons, J.E. Sun Co., Inc., Marcus Hook, PA (United States). Research and Development Dept. [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-90MC26029. (CONF-950494–14: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012318. Source: OSTI; NTIS; GPO Dep.

During the stage at which this work ended, our program consisted of two phases which were running concurrently, a research phase and a proof-of-concept phase. The function of the research phase is to design synthesize and perform laboratory tests on new materials in order to enhance the catalytic properties of the suprabiotic systems generated in our laboratories. Increases in catalytic activity and process selectivity as well as extensions of structure-activity relationships are examined. The research phase is intended to provide the process development phases with catalysts having superior properties for light alkane oxidation. The second concurrent phase, is the proof-of-concept phase. In this phase process development of oxidations which have succeeded in the research phase are carried out in a pre-pilot PDU. At the conclusion of the cooperative agreement we were developing a process for the conversion of isobutane to (TBA), We have identified two routes for this transformation: a one-step route directly from isobutane to TBA, and a two-step route in which the isobutane is oxidized first to tert-butyl hydroperoxide and then transformed into TBA catalytically. This paper presents the results of these activities.

21104 (DOE/MC/29228–95/C0462) **Selective methane oxidation over promoted oxide catalysts.** Klier, K.; Herman, R.G. Lehigh Univ., Bethlehem, PA (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-92MC29228. (CONF-950494–12: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012319. Source: OSTI; NTIS; GPO Dep.

Principal accomplishments have been achieved in all three areas of selective catalytic oxidation of methane that have been pursued in this research project. These accomplishments are centered on the development of catalyst systems that produce high space time yields of C_2 hydrocarbon products, formaldehyde, and methanol from methane/air mixtures at moderate temperatures and at ambient pressure. The accomplishments can be summarized as the following: the $SO_4^{2-}/SrO/La_2O_3$ catalyst developed here has been further optimized to produce 2 kg of C_2 hydrocarbons/kg catalyst/hr at 550C; $V_2O_5SiO_2$ catalysts have been prepared that produce up to 1.5 kg formaldehyde/kg catalyst/hr at 630C with CO_2 selectivities; and a novel dual bed catalyst system has been designed and tested that produces over 100 g methanol/kg catalyst/hr at 600C.

21105 (DOE/PC/92112–T9) **Novel catalysts for methane activation. Quarterly report No. 9, October 1, 1994–December 31, 1994.** Hirschon, A.S.; Wu, H.J.; Malhotra, R.; Wilson, R.B. SRI International, Menlo Park, CA (United States). 20 Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92112. Order Number DE95014323. Source: OSTI; NTIS; GPO Dep.

Fullerenes are a recently discovered allotrope of carbon that have been found to possess unusual properties, some of which may be ideal for methane activation. This project is designed to evaluate these carbon-based materials for conversion of methane into higher hydrocarbons. The project is divided into three technical tasks. Task 1 deals with synthesis and characterization of the fullerenes and fullerene soots, Task 2 with testing of the catalysts, and Task 3 with evaluation of the results and technical reporting. The results and accomplishments for this quarter are as follows: Reconstituted fullerene soot was prepared by adding C_{60} to a toluene-extracted Terrasimco fullerene soot; K-doped fullerene soots of different potassium concentrations were prepared; Fullerene soot doped with cesium was prepared by addition of cesium carbonate; The reconstituted fullerene soot was tested for methane activation. K-doped soots at different K concentrations were tested for methane activation. K-doped soot was examined for methane activation in the presence of co-feeds of either ethane or ethylene; a higher selectivity to C_3 and C_4 hydrocarbons was observed for the K-soot than when these reactions were conducted using soot as a catalyst, or when thermally induced. The Cs-doped soot was tested for methane activation; the selectivity for hydrocarbons from the methane conversion catalyzed by this soot was found to be higher than catalyzed by fullerene soot but lower than by K-soot.

21106 (DOE/PC/92113–T7) **Methane coupling by membrane reactor, Quarterly technical progress report, September 1994–December 24, 1994.** Ma, Yi Hua. Worcester Polytechnic Inst., MA (United States). 14 Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92113. Order Number DE95012418. Source: OSTI; NTIS; GPO Dep.

Experimental studies presented in this report discuss the performance of porous VYCOR membrane reactors in which the oxidative coupling of methane was carried out in an excess of oxygen. This was accomplished by shortening the porous section of the membrane reactor and operating at lower W/F ratios. Results are also discussed from experiments in which methane gas flow was metered in from the high pressure shell side into the oxygen stream on the tube side of the membrane reactor. These studies indicated that the presence of gas phase oxygen downstream to the catalyst bed was detrimental for the C_2 selectivity in the methane coupling reaction. Dense membrane synthesis and characterization results are presented which describe new approaches to dense membrane synthesis. Modifications to the 40 Angstrom pore diameter gamma alumina membranes to enhance their stability and pore filling of micron size pores on alpha alumina supports are discussed. $Sr_{0.8}La_{0.2}FeO_3$, an oxygen conducting perovslcite synthesized in the Microfluidizer showed interesting DSC (Differential Scanning Calorimetry) and TGA (Thermo Gravimetric Analysis) spectra that indicated a change in the crystal structure at relatively moderate temperatures of 150°C and 350°C. This report also presents details of the design and experimental set-up of a catalytic membrane reactor in which the porous membrane is doped with the active catalyst and methane coupling occurs as the reactant gases pass through the membrane pores.

1004 Combustion

Refer also to citation(s) 21538

1009 Environmental Aspects

Refer also to citation(s) 21537

21107 (NREL/TP–425-7607) **The origin and fate of organic pollutants from the combustion of alternative fuels.** National Renewable Energy Lab., Golden, CO (United States); Dayton Univ., OH (United States). Research Inst. Jun 1995. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009232. Source: OSTI; NTIS; INIS; GPO Dep.

The overall objective of this project is to determine the impact of alternative fuels on air quality, particularly ozone formation. The objective will be met through three steps: (1) qualitative identification of alternative fuel combustion products, (2) quantitative measurement of specific emission levels of these products, and (3) determination of the fate of the combustion products in the atmosphere. The alternative fuels of interest are methanol, ethanol, natural gas, and LP gas. The role of the University of Dayton Research Institute (UDRI) in this project is two-fold. First, fused silica flow reactor instrumentation is being used to obtain both qualitative identification and quantitative data on the thermal degradation products from the fuel-lean (oxidative), stoichiometric, and fuel-rich (pyrolytic) decomposition of methanol, ethanol, liquefied petroleum gas, and natural gas. Secondly, a laser photolysis/laser-induced fluorescence (LP/LIF) apparatus is being used to determine the rates and mechanisms of reaction of selected degradation products under atmospheric conditions. This draft final report contains the results of the second year of the study. The authors initially discuss the results of their flow reactor studies. This is followed by a discussion of the initial results from their LP/LIF studies of the reaction of hydroxyl (OH) radicals with methanol and ethanol. In the coming year, they plan to obtain quantitative data on the oxidation of methyl-t-butyl-ether and reformulated gasoline under fuel-lean, stoichiometric, and fuel-rich conditions. They also plan to conduct a mechanistic analysis of the reaction of OH with acetaldehyde and formaldehyde over an extended temperature range.

13 HYDRO ENERGY

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 21109, 21111

21108 (ANL/DIS/CP–85855) **Optimizing hourly hydro operations at the Salt Lake City Area integrated projects.** Veselka, T.D. (Argonne National Lab., IL (United States)); Hamilton, S.; McCoy, J. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950414–2: 57. annual American power conference, Chicago, IL (United States), 18-20 Apr 1995). Order Number DE95012925. Source: OSTI; NTIS; INIS; GPO Dep.

The Salt Lake City Area (SLCA) office of the Western Area Power Administration (Western) is responsible for marketing the capacity and energy generated by the Colorado Storage, Collbran, and Rio Grande hydropower projects. These federal resources are collectively called the Salt Lake City Area Integrated Projects (SLCA/IP). In recent years, stringent operational limitations have been placed on several of these hydropower plants including the Glen Canyon Dam, which accounts for approximately 80% of the SLCA/IP resources. Operational limitations on SLCA/IP hydropower plants continue to evolve as a result of decisions currently being made in the Glen Canyon Dam Environmental Impact Statement (EIS) and the Power Marketing EIS. To analyze a broad range of issues associated with many possible future operational restrictions, Argonne National Laboratory (ANL), with technical assistance from Western has developed the Hydro LP (Linear Program) Model. This model simulates hourly operations at SLCA/IP hydropower plants for weekly periods with the objective of maximizing Western's net revenues. The model considers hydropower operations for the purpose of serving SLCA firm loads, loads for special projects, Inland Power Pool (IPP) spinning reserve requirements, and Western's purchasing programs. The model estimates hourly SLCA/IP generation and spot market activities. For this paper, hourly SLCA/IP hydropower plant generation is simulated under three operational scenarios and three hydropower conditions. For each scenario an estimate of Western's net revenue is computed.

1306 Environmental Aspects

Refer also to citation(s) 22267

21109 (DOE/EA–0934) **Snake River Sockeye Salmon Sawtooth Valley Project: Conservation & rebuilding program: Supplemental final environmental assessment.** USDOE Bonneville Power Administration, Portland, OR (United States). Mar 1995. 47p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012244. Source: OSTI; NTIS; GPO Dep.

This document announces Bonneville Power Administration's (BPA) proposal to fund three separate but interrelated actions which are integral components of the overall Sawtooth Valley Project to conserve and rebuild the Snake River Sockeye salmon run in the Sawtooth Valley of south-central Idaho. The three actions are as follows: (1) removing a rough fish barrier dam on Pettit Lake Creek and constructing a weir and trapping facilities to monitor future sockeye salmon adult and smolt migration into and out of Pettit Lake; (2) artificially fertilizing Readfish Lake to enhance the food supply for Snake River sockeye salmon juveniles released into the lake; and (3) trapping kokanee fry and adults to monitor the fry population and to reduce the population of kokanee in Redfish Lake. BPA has prepared a supplemental EA (included) which builds on an EA compled in 1994 on the Sawtooth Valley Project. Based on the analysis in this Supplemental EA, BPA has determined that the proposed actions are not major Federal actions significantly affecting the quality of the human environment. Therefore an Environmental Impact Statement is not required.

21110 (DOE/EA–0940) **Hellsgate Winter Range: Wildlife Mitigation Project. Final Environmental Assessment.** USDOE Bonneville Power Administration, Portland, OR (United States). Mar 1995. 82p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012404. Source: OSTI; NTIS; INIS; GPO Dep.

BPA proposes to fund the Hellsgate Winter Range: Wildlife Mitigation Project (Project) in a cooperative effort with the Colville Confederated Tribes and the Bureau of Indian Affairs (BIA). The Project is intended to mitigate for wildlife and wildlife habitat adversely affected by the construction of Grand Coulee and Chief Joseph Dams and their reservoirs. The Project would allow the sponsors to secure land and conduct wildlife habitat improvement and long-term management activities within the boundaries of the Colville Indian Reservation. BPA has prepared an Environmental Assessment (EA) (DOE/EA-0940) evaluating the potential environmental effects of the proposed Project (Alternative B) and No Action (Alternative A). Protection and re-establishment of riparian and upland habitat on the Colville Indian Reservation, under Alternative B, would not have a significant adverse environmental impact because: (1) there would be only limited, mostly short-term adverse impacts on soils, water quality, air quality, vegetation, and wildlife (including no effect on endangered species); and (2) there would be no adverse effect on water quantity, cultural resources, or land use. Based on the analysis in the EA, BPA has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required and BPA is issuing this FONSI.

21111 (INIS-BR–3538) **Caxingo - a promising model for integrating the hydroelectric work camps to the site communities.** Luna, A.M. Companhia Hidroeletrica do Sao Francisco (CHESF), Recife, PE (Brazil)); Falcao, A.A. Companhia Paranaense de Energia (COPEL), Curitiba, PR (Brazil). 1989. 5p. (In Portuguese). (CONF-8910591–: 10. national seminar on production and transmission of electric power, Curitiba (Brazil), 1-5 Oct 1989). Order Number DE95632376. Source: OSTI; NTIS (US Sales Only); INIS.

The social and economical impacts caused by the hydroelectric work camps in the sites where the hydroelectric will be constructed are studied, analysing the great supply of works when the hydroelectric is been constructed face to the reduction one when the works are concluded; the neglect by the State in providing medical and educational assistances to the neighbour populations; the appearance of a commerce in the neighbour areas; the employer stableness in the camp after the pension and the lack by the neighbour cities of a social and economical substructure to offer to the population, that come with the hydroelectric construction. A new solution for these problems is presented in the Xingo camp, where the camp will be as a district of city near to the work, with community services provide by the State and the needful substructure to its construction and the equipment provide by the concessionaire. (C.G.C.). 1 fig.

21112 (NEI-DK–2068) **The utilization of water courses for the production of electric power. Report from a working group.** Skov- og Naturstyrelsen, Hoersholm (Denmark). 1992. 49p. (In Danish). Order Number DE95787833. Source: OSTI; NTIS; INIS.

The problems connected with damming Danish water courses to enable the production of hydroelectricity are discussed. These constraints are generally related to conservation principles and cultural historical interests. It is observed that attempts are usually made to remove dams constructed in water courses such as streams and brooks, in order to ensure the free passage of fish and small animals and it is the opinion of the working group that this policy should continue to be followed. Otherwise alternative methods (such as fish staircases and fish sluices) should be set up to enable the fish to pass through without getting entangled with any turbines. Consideration must be given to the preservation of items of cultural-historical interest. Where waters are stagnant, at least half of the water volume should be left untouched for fish passage, and in other non-stagnant water areas water should be reserved for fish passage. The amount of necessary water volume should be assessed in individual cases. The local authorities have agreed that legislation on dams, the establishment of fauna and fish passages and the dedication of free waters to fish passage should be coordinated. (AB)

14 SOLAR ENERGY

1405 Solar Energy Conversion

Refer also to citation(s) 21648, 21707

21113 (BNL–61769) **Waste reduction options for manufacturers of copper indium diselenide photovoltaic cells.** DePhillips, M.P.; Fthenakis, V.M.; Moskowitz, P.D. Brookhaven National Lab., Upton, NY (United States). Mar 1994. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012517. Source: OSTI; NTIS; GPO Dep.

This paper identifies general waste reduction concepts and specific waste reduction options to be used in the production of copper indium diselenide (CIS) photovoltaic cells. A general discussion of manufacturing processes used for the production of photovoltaic cells is followed by a description of the US Environmental Protection Agency (EPA) guidelines for waste reduction (i.e., waste minimization through pollution prevention). A more specific discussion of manufacturing CIS cells is accompanied by detailed suggestions regarding waste minimization options for both inputs and outputs for ten stages of this process. Waste reduction from inputs focuses on source reduction and process changes, and reduction from outputs focuses on material reuse and recycling.

21114 (NREL/TP–413-7991) **Fabrication of stable, large-area thin-film CdTe photovoltaic modules. Final subcontract report, May 10, 1991–February 28, 1995.** Zhou, T.X. (Solar Cells, Inc., Toledo, OH (United States)). National Renewable Energy Lab., Golden, CO (United States); Solar Cells, Inc., Toledo, OH (United States). Jun 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009222. Source: OSTI; NTIS; GPO Dep.

During the period of this subcontract, May 1991 through February 1995, Solar Cells, Inc. has developed and demonstrated a low-cost process to fabricate stable large-area cadmium telluride based thin-film photovoltaic modules. This report summarizes the final phase of the project which is concentrated on process optimization and product life tests. One of the major post-deposition process steps, the $CdCl_2$ heat treatment, has been experimentally replaced with alternative treatments with vapor chloride or chlorine gas. Material and device qualities associated with alternative treatments are comparable or superior to those with the conventional treatment. Extensive experiments have been conducted to optimize the back-electrode structure in order to ensure long term device stability. Numerous small-area cells and minimodules have been subjected to a variety of stress tests, including but not limited to continuous light soak under open or short circuit or with resistive load, for over 10,000 hours. Satisfactory stability has been demonstrated on 48 cm^2 and 64 cm^2 minimodules under accelerated tests and on 7200 cm^2 large modules under normal operating conditions. The conversion efficiency has also been significantly improved during this period. The total area efficiency of 7200 cm^2 module has reached 8.4%, corresponding to a 60.3W normalized output; the efficiency of 64 cm^2 minimodules and 1.1 cm^2 cells has reached 10.5% (aperture area) and 12.4% (total area), respectively.

21115 (NREL/TP–413-8008) **Novel two-stage selenization methods for fabrication of thin-film CIS cells and submodules. Final subcontract report, March 1, 1993–March 31, 1995.** Basol, B. (International Solar Electric Technology, Inglewood, CA (United States)); Kapur, V.; Halani, A.; Leidholm, C.; Minnick, A. National Renewable Energy Lab., Golden, CO (United States); International Solar Electric Technology, Inglewood, CA (United States). Jun 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009229. Source: OSTI; NTIS; GPO Dep.

This is the Phase 11 Final Technical Report of the subcontract titled "Novel Two-Stage Selenization Methods for Fabrication of Thin Film CIS Cells and Submodules." The general objectives of the program are the development of a cost-effective, large-area process for CIS film deposition, optimization of the various layers forming the CIS device structure, and fabrication of high efficiency submodules using these optimized device components. During this research period, growth parameters of ZnO window layers were varied to optimize their electrical and optical properties. Investigation of the chemical interactions between the glass substrates, Mo layers and the selenization atmosphere revealed that the nature of the glass/Mo substrate greatly influenced the quality of the solar cells fabricated on them. Moderate amounts of sodium diffusing from the soda-lime glass substrate into the CIS film improved the efficiencies of the solar cells fabricated on such films. Mo layers allowing excessive Na diffusion through them, on the other hand, reacted excessively with the H^2Se environment and deteriorated the solar cell performance. Addition of Ga into the CIS layers by the two-stage selenization technique yielded graded absorber structures with higher Ga content near the Mo/absorber interface. Cu-rich CIS layers were grown with grain sizes of larger than 5 μm. In the Phase I Annual Report large area CIS submodules with efficiencies of about 3% were reported. During the present Phase II program 1 ft^2 size CIS submodule efficiency was improved to 7%. Smaller area submodules with efficiencies as high as 9.79% were also fabricated using CIS layers obtained by the H_2Se selenization method. The processing yield of the devices based on a non-vacuum CIS deposition approach was improved and solar cells with efficiencies greater than 10% were fabricated.

21116 (NREL/TP–451-8017) **Processing and modeling issues for thin-film solar cell devices. Annual subcontract report, January 16, 1994–January 15, 1995.** Birkmire, R.W. (Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion); Phillips, J.E.; Buchanan, W.A.; Hegedus, S.S.; McCandless, B.E.; Shafarman, W.N. National Renewable Energy Lab., Golden, CO (United States); Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion. Jun 1995. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009237. Source: OSTI; NTIS; GPO Dep.

This report describes results achieved during the second phase of a four year subcontract to develop and understand thin film solar cell technology related to a-Si and its alloys, $CuIn_{1-x}Ga_xSe_2$, and CdTe. Accomplishments during this phase include, development of equations and reaction rates for the formation of $CuIn_{1-x}Ga_xSe_2$ films by selenization, fabrication of a 15% efficient $CuIn_{1-x}Ga_xSe_2$ cell, development of a reproducible, reliable Cu-diffused contact to CdTe, investigation of the role of CdTe-CdS interdiffusion on device operation, investigation of the substitution of HCl for $CdCl_2$ in the post-deposition heat treatment of CdTe/CdS, demonstration of an improved reactor design for deposition of a-Si films, demonstration of improved process control in the fabrication of a ten set series of runs producing ~8% efficient a-Si devices, demonstration of the utility of a simplified optical model for determining quantity and effect of current generation in each layer of a triple stacked a-Si cell, presentation of analytical and modeling procedures adapted to devices produced with each material system, presentation of baseline parameters for devices produced with each material system, and various investigations of the roles played by other layers in thin film devices including the Mo underlayer, CdS and ZnO in $CuIn_{1-x}Ga_xSe_2$ devices, the CdS in CdTe devices, and the ZnO as window layer and as part of the back surface reflector in a-Si devices. In addition, collaborations with over ten research groups are briefly described. 73 refs., 54 figs., 34 tabs.

1406 Photovoltaic Power Systems

21117 (DOE/GO–10095-072) **Public utilities supply solar energy to eager customers.** National Renewable Energy Lab., Golden, CO (United States). Jan 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95000289. Source: OSTI; NTIS; GPO Dep.

This articles examines how photovoltaic power is an alternative source of energy that can help utilities earn goodwill from their customers for being innovative, saving money, and reducing harmful emissions. Planners at municipal utilities are discovering the advantages that photovoltaic (PV) power offers. In addition to the thousands of private, federal, state, and commercial PV systems installed during the last 20 years, more than 65 cities in 24 states also have installed such systems. PV power is cost effective in selected utility applications today, and those applications are expanding every year. PV can be useful in applications ranging from

low-power uses to decentralized applications to large, central stations. Public utilities in Austin and Sacramento are among those successfully using PV power for all three types of applications.

21118 (NEDO-P–9317) **Investigation on designing form of introduction of the photovoltaic power generation system for international cooperation.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 139p. (In Japanese). Order Number DE95786814. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

An investigational study was carried out to effectively make a concrete design in case of introducing the photovoltaic power generation for international cooperation. To well-balancedly integrate it into energy plans of developing countries, it is presently necessary to conduct detailed investigation and design at each target point for introduction and to obtain various technical knowledges. In fiscal 1992, target points for introduction were selected, load patterns, specifications for component equipment, required areas and roughly estimated price are prepared and standardized so that appropriate introduction form can be selected based on meteorological data. A guide for basic design was also formed. In fiscal 1993, programming of this guide was studied, and the basic design was made easily possible using general-purpose computer. By inputting solar radiating conditions and load conditions, specifications for each equipment are automatically selected. Designers make simulational calculation through interaction with personal computer and check supply/demand balance. Further, data to be referred to in the simulation are arranged and filed. 49 figs., 27 tabs.

21119 (NREL/TP–411-8006) **Technical evaluation of a USSC Integrated/Direct Mount PV Roofing Module system at NREL.** Strand, T.; Hansen, R.; Mrig, L. National Renewable Energy Lab., Golden, CO (United States). May 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-950585–2: 13. NREL photovoltaics program review meeting, Lakewood, CO (United States), 16-19 May 1995). Order Number DE95009217. Source: OSTI; NTIS; GPO Dep.

The results of a 16 month technical evaluation performed on a nominal 1 kW_{ac} utility-interconnect amorphous silicon PV system deployed at the National Renewable Energy Laboratory's PV outdoor test site are given here. The system employs 64 prototype United Solar Systems Corp. Integrated/Direct Mount PV Roofing Modules mounted on simulated attic/roof structures. In this paper we show that the PV array fill factor has been relatively stable with respect to time and that the seasonal variations in performance can be largely attributed to seasonal variations in current. We also show that in determining the summer and winter ac power output, the summation of the manufacturer-supplied module peak powers at STC for a similarly located and configured a-Si PV array should be derated by factors of approximately of 0.83 and 0.78 for summer and winter operation, respectively.

21120 (NREL/TP–472-7850) **Building-integrated photovoltaics (BIPV): Analysis and US market potential. Final report.** Frantzis, L. (Little (Arthur D.), Inc., Cambridge, MA (United States)); Friedman, D.; Hill, S.; Teagan, P.; Strong, S.; Strong, M. National Renewable Energy Lab., Golden, CO (United States); Little (Arthur D.), Inc., Cambridge, MA (United States); Solar Design Associates, Harvard, MA (United States). Feb 1995. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004055. Source: OSTI; NTIS; GPO Dep.

Arthur D. Little, Inc., in conjunction with Solar Design Associates, conducted a study for the US Department of Energy (DOE), Office of Building Technologies (OBT) to determine the market potential for grid-connected, building-integrated photovoltaics (BIPV). This study defines BIPV as two types of applications: (1) where the PV modules are an integral part of the building, often serving as the exterior weathering skin; and (2) the PV modules are mounted on the existing building exterior. Both of these systems are fully integrated with the energy usage of the building and have potential for significant market penetration in the US. Off-grid building applications also offer a near-term market for BIPV, but are not included in the scope of this study.

21121 (SAND–95-0904C) **National electrical code changes for 1996 and USA participation in International Energy Agency activities related to photovoltaics safety and grid interconnection.** Bower, W. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950725–2: SOLAR '95: national solar energy conference: 10,000 solutions - paths to a renewable future, Minneapolis, MN (United States), 15-20 Jul 1995). Order Number DE95011892. Source: OSTI; NTIS; GPO Dep.

As photovoltaic (PV) systems gain more acceptance in utility-interactive applications throughout the world, many organizations are placing increasingly higher priorities on writing guidelines, codes and standards. These guidelines and codes are being written to improve safety, installation, acceptance, listing or certification of the PV components or systems. Sandia National Laboratories' PV System Applications Department is working closely with the PV industry to address issues that are associated with fire and personnel safety and with National Electrical Code (NEC) requirements. Additionally, the United States has agreed to participate in two of the International Energy Agency (IEA) Annexes (topical tasks) of the Implementing Agreement for a Cooperative Programme on Photovoltaic Power Systems. This paper describes events and activities associated with the NEC and the IEA that are being led by Sandia National Laboratories with broad participation by the US PV industry.

1407 Solar Thermal Power Systems

Refer also to citation(s) 21132

21122 (SAND–95-1082C) **Technical status of the Dish/Stirling Joint Venture Program.** Bean, J.R. (Cummins Power Generation, Inc., Columbus, IN (United States)); Diver, R.B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950729–6: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95013021. Source: OSTI; NTIS; GPO Dep.

Initiated in 1991; the Dish/Stirling Joint Venture Program (DSJVP) is a 5-year, $17.2 million joint venture which is funded by Cummins Power Generation, Inc. (CPG) of Columbus, Indiana and the United States Department of Energy's (DOE) Solar Thermal and Biomass Power Division. Sandia National Laboratories administers and provides technical management for this contract on the DOE's behalf. In January, 1995; CPG advanced to Phase 3 of this three-phase contract. The objective of the DSJVP is to develop and commercialize a 7-kW. Dish/Stirling System for remote power markets by 1997. In this paper, the technical status of the major subsystems which comprise the CPG 7-kW_e Dish/Stirling System is presented. These subsystems include the solar concentrator, heat pipe receiver, engine/alternator, power conditioning, and automatic controls.

1409 Solar Thermal Utilization

Refer also to citation(s) 20724

21123 (CONF-950336–25) **Experimental evaluation of a simulation model for wrap-around heat exchanger, solar storage tanks.** Miller, J.A.; Hittle, D.C. Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab. [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG36-86SF16306. From American Society of Mechanical Engineers/Japanese Society of Mechanical Engineers/Japan Solar Energy Society international solar energy conference; Lahaina, HI (United States); 19-24 Mar 1995. Order Number DE95011598. Source: OSTI; NTIS; GPO Dep.

The thermal performance of a commercially available 80 gallon, solar storage tank with an integral wrap-around heat exchanger is characterized experimentally an indoor test stand. The experimental results are used to evaluated the accuracy of a previously developed simulation model. Heat input on the collector side of the heat exchanger is held constant causing the heat transfer to reach

a quasi-steady state. Temperatures in the heat exchanger and tank increase with time, however, the temperature differences across the heat exchanger remain nearly constant. Several combinations of heat input and collector loop flow are investigated. The development of the tank temperature profiles over time and the overall heat transfer performance predicted by the model are compared with experimental results. The influence of an electric auxiliary heater located in the top of the solar storage tank on the heat exchanger performance is investigated. Experimental normalization of the model is considered and modifications to the model and experiments are recommended.

21124 (DTU-LV-MEDD–275) **Solar heating system based on the drain-back principle.** Boye-Hansen, L.; Furbo, S. Danmarks Tekniske Univ., Lyngby (Denmark). Lab. for Varmeisolering. Mar 1995. 70p. (In Danish). Contract ENS-51181-93.0019. Order Number DE95787736. Source: OSTI; NTIS.

The use of the drain back principle makes it possible to design cheaper, more reliable solar heating systems with increased thermal performances. Nevertheless almost no drain back systems have so far been built in Denmark. In this project a number of small laboratory investigations concerning different details of the design of drain back systems have been carried out. It was investigated for which conditions there is a freezing risk in the pipe connecting the heat storage with the solar collector on cold mornings when water is pumped from the storage to the collector. It was also investigated how to design the system to avoid water to be sucked up in the solar collector during cold nights. It was further investigated which tilt is needed for the pipes in the solar collector loop to ensure a complete draining of the solar collector. Furthermore, it was investigated if evaporation from the water surface in the solar collector loop during cold nights can result in condensation, ice formation and frost burst in the cold parts of the solar collector loop. In a cooperation with solar collector producers three small test DHW solar heating systems were built. The three systems are drain-back systems making use of water as the solar collector fluid. The systems have different designs. Measurements of the thermal performances of the systems have been carried out. Based on the investigations it is possible to estimate the reliability and thermal performance of the systems. A 52 m^2 drain back solar heating system was built in a building in the spring of 1994. The net utilized solar energy of the system was measured and the measurements were compared with calculated quantities. (au) 15 refs.

21125 (NEI-DK–2022) **Analysis of building-integrated solar heating for Globorama. Final report.** Cowiconsult Raadgivende Ingenioerer A/S, Lyngby (Denmark). May 1995. 37p. (In Danish). Contract ENS-51181-94.0055. Order Number DE95787773. Source: OSTI; NTIS.

Globorama is a permanent exhibition building planned to be built in Herning. It should constitute a tourist attraction the aim of which is to promote awareness of global and local environmental problems and to suggest what the individual can do to help mitigate them. The institution will include activities related to energy and the environment and interactive exhibits will demonstrate the dynamic interplay between nature, human beings and technology. The building itself will be constructed in harmony with the concept of environmental protection, and will integrate solar heating. This model building is described in detail, both architecturally and with relation to energy conservation, ventilation, building materials, heat recovery, temperature regulation, environmental protection and especially the design of the solar heating facilities. (AB)

21126 (NEI-DK–2066) **Development of a multi-function expansion tank.** Dansk Teknologisk Inst., Taastrup (Denmark). Proevestationen for Solenergi; Ringsted Energi Center, Ringsted (Denmark). Jun 1995. 54p. (In Danish). Contract ENS-51181-93.0017. Order Number DE95787836. Source: OSTI; NTIS.

The aim was to develop and test an expansion tank for a solar heating system. The tank should have a number of built-in functions including a safety valve allowing the escape of air and steam, a counter-valve in the form of a liquid lock connected to the solar collector, an automatic deflation of air bubbles from the solar collector, a visual system for checking the level of liquid and the circulation through transparent tubes and the collection of liquid when boiling occurs in the solar collector. This system is less expensive and makes adjustments easier to carry out. The system includes pumps, control equipment and all other necessary equipment with the exception of the solar collector, some tubes and the storage tank. It is suitable for do-it-yourself experts. The system should be on the market by September 1995. (AB)

1410 Solar Collectors and Concentrators

Refer also to citation(s) 21122, 21125

21127 (DTU-LV–95-7) **Efficiencies of solar collectors for different tilts. Measurements.** Furbo, S.; Holck, O. Danmarks Tekniske Univ., Lyngby (Denmark). Lab. for Varmeisolering. May 1995. 7p. Order Number DE95779208. Source: OSTI; NTIS.

The measured heat loss coefficients of solar collectors and by that the efficiencies of the collectors are influenced by the collector tilt. The efficiency is especially influenced by the tilt during operation periods with large (T_m - T_{amb})/G-ratios. The influence of the tilt on the efficiency is different from one collector to another. (au)

21128 (KTH-IT-M–36) **Solar collector model for testing and simulation.** Isakson, P. Royal Inst. of Tech., Stockholm (Sweden). Div. for Building Services Engineering. May 1995. 190p. Project BFR-900280-1. Order Number DE95779292. Source: OSTI; NTIS.

An outdoor test of a collector module requires measurements during a few clear days, which in practice may take weeks to accomplish. Furthermore, performance evaluations of solar heating plants in Sweden are typically expensive and take a couple of years to carry out. Thus, three dynamic flat plate collector software models have been developed by the author; 1. The MFC that models a single collector module, 2. The MFCA that models parallel rows of collectors connected with buried pipes, and 3. The FFC model - a set of frequency functions that extends the collector efficiency factor F' and the heat removal factor F_R to the dynamic case. The MFC model has been thoroughly validated. It faithfully reproduces daylong sequences of measured data, but for transients caused by stepwise changes in the input signals. However, we noted bias errors in our day to day cross-validations. We conclude that the weather varies from one day to another in a way that is neither accounted for in the particular models nor in the measurements. Nevertheless, the results suggest that an outdoor collector test procedure that requires measurements during no more than a few days with fair weather is possible. We proposed a performance test for large collector arrays based on the MFCA model parameterized with one free parameter. The test requires data from regular operation during no more than one month, thus avoiding the cost of specially designed experiments. The accuracy achieved in the long term predictions does not fully satisfy our requirements. Nevertheless, we find the result encouraging and we are confident that some improvements will make the test useful in practice. 60 refs

21129 (PNL–10416) **Final project report - CRADA with United Solar Technologies and Pacific Northwest Laboratory (PNL-021): Thin film materials for low-cost high performance solar concentrators.** Martin, P.M.; Affinito, J.D.; Gross, M.E.; Bennett, W.D. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010423. Source: OSTI; NTIS; GPO Dep.

The objectives of this project were as follows: To develop and evaluate promising low-cost dielectric and polymer-protected thin-film reflective metal coatings to be applied to preformed continuously-curved solar reflector panels to enhance their solar reflectance, and to demonstrate protected solar reflective coatings on preformed solar concentrator panels. The opportunity for this project arose from a search by United Solar Technologies (UST) for organizations and facilities capable of applying reflective coatings to large preformed panels. PNL was identified as being uniquely qualified to participate in this collaborative project.

21130 (SAND–94-1832) **The lustering of TBC-2.** Diver, R.B.; Jones, S.; Robb, S.; Mahoney, A.R. Sandia National Labs., Albuquerque, NM (United States). May 1995. 30p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012113. Source: OSTI; NTIS; GPO Dep.

Two test bed concentrators (TBCs) were designed to provide high-performance test beds for advanced solar receivers and converters. However, the second-surface silvered-glass mirror facets on the TBCs, which were originally manufactured by the Jet Propulsion Laboratory, have experienced severe silver corrosion. To restore reflectance, TBC-2 was refurbished with a lustering technique developed at Sandia National Laboratories. In the lustering technique, second-surface silvered thin-glass mirrors were applied over the corroded facets, thereby increasing the dish reflectivity and raising the available power of TBC-2 from approximately 70 to 78 kW_t. Degradation of the original optical accuracy of the TBC facets was determined to be minimal. Lustering was chosen over facet replacement because of the lower cost, the anticipated improvement in corrosion resistance, and the shorter project duration. This report includes background information, details of the lustering process, and test results from TBC-2 characterization, both before and after lustering.

21131 (SAND–94-1884) **Test results: SEGS LS-2 solar collector.** Dudley, V.E. (EG&G Special Projects, Albuquerque, NM (United States)); Kolb, G.J.; Mahoney, A.R.; Mancini, T.R.; Matthews, C.W.; Sloan, M.; Kearney, D. Sandia National Labs., Albuquerque, NM (United States). Dec 1994. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010682. Source: OSTI; NTIS; GPO Dep.

A SEGS LS-2 parabolic trough solar collector was tested to determine the collector efficiency and thermal losses with two types of receiver selective coatings, combined with three different receiver configurations: glass envelope with either vacuum or air in the receiver annulus, and glass envelope removed from the receiver. As expected, collector performance was significantly affected by each variation in receiver configuration. Performance decreased when the cermet selective coating was changed to a black chrome coating, and progressively degraded as air was introduced into the vacuum annulus, and again when the glass envelope was removed from the receiver. For each receiver configuration, performance equations were derived relating collector efficiency and thermal losses to the operating temperature. For the bare receiver (no glass envelope) efficiency and thermal losses are shown as a function of wind speed. An incident angle modifier equation was also developed for each receiver case. Finally, equations were derived showing collector performance as a function of input insolation value, incident angle, and operating temperature. Results from the experiments were compared with predictions from a one-dimensional analytical model of the solar receiver. Differences between the model and experiment were generally within the band of experimental uncertainty.

21132 (SAND–94-2059C) **Development of a 75-kW heat-pipe receiver for solar heat-engines.** Adkins, D.R.; Andraka, C.E.; Moss, T.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505155–2: 9. international heat pipe conference, Albuquerque, NM (United States), 1-5 May 1995). Order Number DE95011604. Source: OSTI; NTIS; GPO Dep.

A program is now underway to develop commercial power conversion systems that use parabolic dish mirrors in conjunction with Stirling engines to convert solar energy to electric power. In early prototypes, the solar concentrator focused light directly on the heater tubes of the Stirling engine. Liquid-metal heat-pipes are now being developed to transfer energy from the focus of the solar concentrator to the heater tubes of the engine. The dome-shaped heat-pipe receivers are approximately one-half meters in diameter and up to 77-kW of concentrated solar energy is delivered to the absorber surface. Over the past several years, Sandia National Laboratories, through the sponsorship of the Department of Energy, has conducted a major program to explore receiver designs and identify suitable wick materials. A high-flux bench-scale system has been developed to test candidate wick designs, and full-scale systems have been tested on an 11-meter test-bed solar concentrator. Procedures have also been developed in this program to measure the properties of wick materials, and an extensive data-base on wick materials for high temperature heat pipes has been developed. This paper provides an overview of the receiver development program and results from some of the many heat-pipe tests.

1420 Heat Storage

Refer also to citation(s) 21327

15 GEOTHERMAL ENERGY

21133 (LBL–36873) **Large-scale three-dimensional geothermal reservoir simulation on small computer systems.** Antunez, E.; Moridis, G.; Pruess, K. Lawrence Berkeley Lab., CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950514–13: World geothermal congress: worldwide utilization of geothermal energy, Florence (Italy), 18-31 May 1995). Order Number DE95012382. Source: OSTI; NTIS; GPO Dep.

The performance of TOUGH2, Lawrence Berkeley Laboratory's general purpose simulator for mass and heat flow and transport enhanced with the addition of a set of preconditioned conjugate gradient solvers, was tested on three PCs (486-33, 486-66, Pentium-90), a MacIntosh Quadra 800, and a workstation IBM RISC 6000. A two-phase, single porosity, 3-D geothermal reservoir model with 1,411 irregular grid blocks, with production from and injection into the reservoir was used as the test model. The code modifications to TOUGH2 and its setup in each machine environment are described. Computational work per time step and CPU time requirements are reported for each of the machines used. It is concluded that the current PCs provide the best price/performance platform for running large-scale geothermal field simulations that just a few years ago could only be executed on mainframe computers and high-end workstations.

1501 Resources and Availability

21134 (NEDO-P–9325) **Fundamental investigation for widening utilization of hot dry rock resource.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 321p. (In Japanese). Order Number DE95786806. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

For the purpose of making wide use of hot dry rock resource, investigation was conducted into grasp of its resource amount and potential utilization. The amount of hot dry rock resource (unit: 10^{15}kcal) in 29 areas investigated this time was as follows: as to shallow-area resource; it was 200 and 145 in the depth up to 3 km and at temperatures over 200°C and over 250°C, respectively, and as to deep-area resource in the depth of 3-5 km, it was 491. Among the areas, 7 areas were regarded as promising. Models proposed by Greengarten and others are improved to calculate potential power generation amount. In case it is in the shallow area and more than 30,000 kW in size, hot dry rock energy is possibly competitive with other energy. In case it is 3,000 kW in size, it is low in economy as energy for power generation and necessary to be regarded as local energy which should be multi-purposely used. If it is in the deep area, hot dry rock energy is low in economy in case of about 10,000 kW in size, but possibly competitive with other energy in case of large scale development of more than 100,000 kW in size. Also studied was a possibility of expanding use of hot dry rock energy except power generation. 63 refs., 160 figs., 53 tabs.

1502 Geology and Hydrology of Geothermal Systems

21135 (USGS-OFR–94-553) **Volcanic activity and ground deformation hazard analysis for the Hawaii Geothermal Project Environmental Impact Statement.** Kauahikaua, J. (Geological Survey, Hawaii National Park, HI (United States). Hawaiian Volcano

Observatory); Moore, R.B.; Delaney, P. Minerals Management Service, Menlo Park, CA (United States); Geological Survey, Hawaii National Park, HI (United States). Hawaiian Volcano Observatory; Geological Survey, Denver, CO (United States); Geological Survey, Flagstaff, AZ (United States). [1994]. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22089. Order Number DE95013084. Source: OSTI; NTIS; GPO Dep.

The Hawaii Geothermal Project involves the development of a geothermal resource for electrical power production within three geothermal subzones on the east rift zone of Kilauea volcano. The Project includes overland transmission of this power to the west coast of Hawai'i and via submarine cable to O'ahu. In this report, lava flow and ground deformation hazard are evaluated for the three geothermal subzones and for the three proposed overland transmission routes. The time interval for evaluating hazards was chosen as 50 years because that is consistent with seismic design standards in the Uniform Building Code, and because of limited information on occurrence dates.

1503 Geothermal Exploration and Exploration Technology

21136 (ETDE/JP-mf–95786807) **Report on verification survey on fiscal 1993 geothermal exploration technology. Development of fracture type reservoir exploring method/ development of electromagnetic wave utilization probing method (development of Array CSMT method).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 144p. (In Japanese). Order Number DE95786807. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The paper reports the results of development of an array type CSMT method conducted in fiscal 1993. As for the array CSMT method probing system, such improvements are made as addition of a function of the MT method for receiving natural signal to the receiver, and employment of multi-core cable, etc. As to software, the MT method data and the array CSMT method data are connected, and the program is improved so that the data can be processed without near field effects. Further, the following were carried out: take-in of resistivity logging data, improvement of noise resistance, response to discontinued frequency data. The experiment on application of this system was conducted in the Sumikawa area in Akita Pref. As a result, the following results were obtained despite of noise from construction work of the power plant: acquisition of good data, improvement of traverse line setting efficiency, quality improvement of high frequency band data using signal booster, etc. In the inversion analysis made jointly with MT method data, well reflected were fracture type structures and alteration zones. 48 figs., 8 tabs.

21137 (ETDE/JP-mf–95786815) **Geothermal development promotion survey in fiscal 1993 (Yamaaoizawa area No.C-2). Fiscal annual influence survey report on the environment.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 207p. (In Japanese). Order Number DE95786815. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

As a survey in fiscal 1993 to promote the geothermal development, the first annual influence was surveyed on the environment in Yamaaoizawa Area No. C-2. The present survey was conducted to grasp the influence of geothermal exploration drilling on the environment, and simultaneously, present status of necessary environmental elements before starting the survey and development. Located in a mountainous district, about 14km southeast of the center of Okachi Town, Akita Prefecture, the surveyed area covers Takamatsu Region, Yuzawa City, and a part of Akinomiya Region, Okachi Town. Having an area of about 8km^2, it is a hardly flat land lying at the altitude of about 500 to 1200m. Kawarage Spa which is naturally fumarolic is located in its northeast, while both Doroyu and Niiyu Spas are done in its east. With the exception of Kigiyama Spa and swimming pool use hot spring well, fluctuation is observed in hot water temperature and discharging rate in Takamatsu Spa, both Ogura and Okuyama Hotels of Doroyu Spa, Arayu Spa, Yunotai-Shingoro Spa, and Well T-501 through before, during and after the exploratory drilling. However, this fluctuation is judged to be not attributable to the exploratory drilling, but to the change in mateorological and seasonal conditions. 47 figs., 26 tabs.

21138 (ETDE/JP-mf–95786816) **Geothermal development promotion survey report in fiscal 1992. 37. Influence survey on the environment in Hongu Area.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 45p. (In Japanese). Order Number DE95786816. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The area around Hongu Town, Wakayama Prefecture was surveyed to know the influence of exploratory drilling and other geothermal development works on the hot spring and other environments. The influence of exploratory drilling and HG-2 well hot water collection test was surveyed at six Na-HCO3/Cl type hot springs, of which the hot water temperature, discharging rate and pH were 66.5 to 91.5°C, 17 to 402l/min and 7.2 to 7.9, respectively. Their evaporation residue can be classified by weight per liter into two groups, i.e., 1100 to 1200mg/l and 810 to 970mg/l. No particularly large difference was made in chemical composition between the pre-fumarolic survey and second annual survey. With the exception of discharging rate, all the other survey items hardly fluctuated with a smaller fluctuation coefficient than 10%. No remarkable change was observed through before, during and after the exploratory drilling, which therefore suggested that the hot spring was stable during the fluctuation survey, continuously conducted since the beginning of pre-fumarolic survey. The hot spring did not remarkably change during the hot water collection as well as through before, during and after the well drilling. 5 figs., 5 tabs.

1506 Environmental Aspects

Refer also to citation(s) 21137, 21138

21139 (DOE/OR/22088–T1) **Surveys of forest bird populations found in the vicinity of proposed geothermal project subzones in the district of Puna, Hawaii.** Jacobi, J.D.; Reynolds, M.; Ritchotte, G.; Nielsen, B.; Viggiano, A.; Dwyer, J. Fish and Wildlife Service, Hawaii National Park, HI (United States). Hawaii Research Station. Oct 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22088. Order Number DE95013081. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents data on the distribution and status of forest bird species found within the vicinity of proposed geothermal resource development on the Island of Hawaii. Potential impacts of the proposed development on the native bird populations found in the project are are addressed.

21140 (DOE/OR/22088–T2) **Vegetation component of geothermal EIS studies: Introduced plants, ecosystem stability, and geothermal development.** Fish and Wildlife Service, Hawaii National Park, HI (United States). Hawaii Research Station. Oct 1994. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22088. Order Number DE95013080. Source: OSTI; NTIS; INIS; GPO Dep.

This paper contributes new information about the impacts from introduced plant invasions on the native Hawaiian vegetation as consequences of land disturbance and geothermal development activities. In this regard, most geothermal development is expected to act as another recurring source of physical disturbance which favors the spread and maintenance of introduced organisms throughout the region. Where geothermal exploration and development activities extend beyond existing agricultural and residential development, they will become the initial or sole source of disturbance to the naturalized vegetation of the area. Kilauea has a unique ecosystem adapted to the dynamics of a volcanically active landscape. The characteristics of this ecosystem need to be realized in order to understand the major threats to the ecosystem and to evaluate the effects of and mitigation for geothermal development in Puna. The native Puna vegetation is well adapted to disturbances associated with volcanic eruption, but it is ill-adapted

to compete with alien plant species in secondary disturbances produced by human activities. Introduced plant and animal species have become a major threat to the continued presence of the native biota in the Puna region of reference.

21141 (ETDE/JP-mf–95786813) **Survey of fiscal 1993 geothermal development promotion. 38. Western area of Mt. Aso (Report on the third year environmental effect survey).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Jan 1995. 45p. (In Japanese). Order Number DE95786813. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

In the western area of Mt. Aso, a survey was conducted of effects of drilling of exploration wells on the environment for geothermal development. Following fiscal 1991, the survey was carried out in terms of ingredient and variations of the five spas in the area. The results of the survey are as follow: No. 1 spa is large in variations of amount of discharge water, anion, and electric conductivity, but there are no correlations among items of survey. No. 2 spa is large in variations of amount of discharge, but stable in the other items. No. 3 showed large variations in every item, and indicated positive correlation between temperature of the spa and amount of discharge and negative correlation between PH and EC. No. 4 spa showed small variations in every item and stable in amount of discharge. No. 5 spa is stable in temperature of the spa and PH, but after much rainfall the discharge rapidly increased, and ion and EC decreased. It is thought that these are caused by large influence of difference in the climate situation such as precipitation of every fiscal year. No variations are seen which are thought to be brought about by drilling of the exploration well. 3 refs., 6 figs., 10 tabs.

1509 Geothermal Engineering

Refer also to citation(s) 21398

21142 (LBL–36849) **Numerical simulation of water injection into vapor-dominated reservoirs.** Pruess, K. Lawrence Berkeley Lab., CA (United States). Jan 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950514–12: World geothermal congress: worldwide utilization of geothermal energy, Florence (Italy), 18-31 May 1995). Order Number DE95012390. Source: OSTI; NTIS; GPO Dep.

Water injection into vapor-dominated reservoirs is a means of condensate disposal, as well as a reservoir management tool for enhancing energy recovery and reservoir life. We review different approaches to modeling the complex fluid and heat flow processes during injection into vapor-dominated systems. Vapor pressure lowering, grid orientation effects, and physical dispersion of injection plumes from reservoir heterogeneity are important considerations for a realistic modeling of injection effects. An example of detailed three-dimensional modeling of injection experiments at The Geysers is given.

1510 Direct Energy Utilization

Refer also to citation(s) 22946

1520 Geothermal Data and Theory

Refer also to citation(s) 21709

1530 Health and Safety

Refer also to citation(s) 21138

17 WIND ENERGY

1704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 21150

21143 (NEI-DK–2067) **Description and evaluation of foreign wind turbine technology.** Petersen (H.) Consult, Broenshoej (Denmark); Darup Associates ApS (Denmark). Jun 1995. 87p. (In Danish). Contract ENS-51171-93.0045. Order Number DE95787835. Source: OSTI; NTIS; INIS.

It is stated that sales of Danish-manufactured wind turbines abroad are decreasing due to an increase in production, marketing and technology research in other countries. The aim was to give an account of this international development which could form the basis for the future strategies of the Danish Wind turbine industry. The study is based on a survey of relevant literature, interviews with experts on the subject and the collection of the latest data. The survey is limited to wind turbines with a larger capacity than 50 kW. Recommendations are given as to how to conserve and develop the market for Danish wind turbines. (AB) 17 refs.

1705 Environmental Aspects

21144 (DOE/EIS–0206) **Proposed Columbia Wind Farm #1. Joint NEPA/SEPA draft environmental impact statement.** US-DOE Bonneville Power Administration, Portland, OR (United States). Mar 1995. 255p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012240. Source: OSTI; NTIS; INIS; GPO Dep.

This Draft Environmental Impact Statement (DEIS) addresses the Columbia Wind Farm #1 (Project) proposal for construction and operation of a 25 megawatt (MW) wind power project in the Columbia Hills area southeast of Goldendale in Klickitat County, Washington. The Project would be constructed on private land by Conservation and Renewable Energy System (CARES) (the Applicant). An Environmental Impact Statement is required under both NEPA and SEPA guidelines and is issued under Section 102 (2) (C) of the National Environmental Policy Act (NEPA) at 42 U.S.C. 4321 et seq and under the Washington State Environmental Policy Act (SEPA) as provided by RCW 43.21C.030 (2) (c). Bonneville Power Administration is the NEPA lead agency; Klickitat County is the nominal SEPA lead agency and CARES is the SEPA co-lead agency for this DEIS. The Project site is approximately 395 hectares (975 acres) in size. The Proposed Action would include approximately 91 model AWT-26 wind turbines. Under the No Action Alternative, the Project would not be constructed and existing grazing and agricultural activities on the site would continue.

21145 (NEI-DK–2065) **Does noise from wind turbines change due to age? Noise generated by gears at Kyndby wind turbine array.** Astrup, T. Oedegaard og Danneskiold-Samsoee ApS, Copenhagen (Denmark). Mar 1995. 17p. (In Danish). Contract ENS-1363/94-0008. Order Number DE95787839. Source: OSTI; NTIS; INIS.

EFP-94.

Continuous measurements were taken of noise emission from the gears of two wind turbines at Kyndby wind turbine array in Denmark during the period 1989-94 in order to determine whether the character of the noise altered with time. The gears were renovated during 1992. In the case of wind turbine 11 the dominating gear noise changed from 400 Hz to 416 Hz and noise emission from the gears of wind turbine 13 changed from 400 Hz to 350 Hz. After the renovation the noise from turbine 11 and turbine 13 respectively was reduced by 13 dB and 11 dB. The gear-noise is determined as A-weighted sound effect level of sound with a reference wind velocity of 8 m/a. During 1990-94 the gear-noise from turbine 11 increased by 6 dB while it decreased by a further 3 dB in the case of turbine 13. It is concluded that in the case of one turbine the noise emission constantly increased after renovation in contrast to the other where noise pollution decreased after renovation. Meshing at 416 Hz is close to the torsional resonances in the gearbox. These results could indicate that the frequency of meshing close to torsional resonances should be avoided when designing gearboxes. (AB)

1706 Wind Energy Engineering

Refer also to citation(s) 21143

21146 (EEV–95-01) **Report on measurements taken on Nibe windmill A, which is fitted with wooden blades. Measuring period 1991 - 1993.** Hansen, K.S. (DTU, Afd. for Fluid Mekanik (Denmark)); Oeye, S. Danske Elvaerkers Forenings Udredningsafdeling (DEFU), Lyngby (Denmark). May 1995. 124p. (In Danish). Contract ENS-1364/91-0007. Order Number DE95787742. Source: OSTI; NTIS.

EFP-91.

An analysis of measurements taken on the Danish manufactured Nibe wind turbine A during the period 1991-1993 when it operated with active stall control attached to a set of wooden wings. The construction and design of the windmill is described and a number of the windmill's typical operational situations are illustrated with a time series plot of the measured loads. The efficiency curve, structural stresses, fatigue stresses, and 1P equivalent moment widths are determined and system frequencies are identified. (AB) 20 refs.

21147 (NEI-DK–2062) **Propagation of wind turbine noise. Outline of a prediction method.** Kragh, J. (DELTA Acoustics and Vibration, Lyngby (Denmark)); Jakobsen, J.; Plovsing, B.; Andersen, B.; Backalarz, C.; Larsen, P. Dansk Teknologisk Inst., Aarhus (Denmark). Miljoeteknik. May 1995. 51p. Contract ENS-1364/93-0007; Contract JOUL-CT92-0124. Order Number DE95787838. Source: OSTI; NTIS.

EFP-93.

This report describes a series of field measurements of sound propagating from a loudspeaker 22 m above ground. The measurement results are used as a basis for a method to predict noise from wind turbines. The outline of the method seems rather clear even if a number of details still have to be worked out. We combined the field data with theory and found that downwind ground effect can be accurately described by theory for straight-line propagation (no wind) provided we increase the source height in the calculations. We propose this as a method for predicting downwind noise levels from wind turbines and we believe the results can be generalized to be valid outside the range of distances, heights and terrain roughness represented in our present data. We also believe the theoretical calculations in 1/3 octave bands could be approximated by accurate yet simple octave band calculations but time did not permit us to do so within the project. Crosswind data showed more spread than downwind data. This is natural, since crosswind in practice sometimes is slightly upwind and sometimes slightly downwind. The data showed a fair agreement with straight-line predictions and we propose to predict crosswind ground effect based on theory for 'no wind' without modifying the source height. Also data from upwind propagation measurements showed considerable spread. At low frequencies we propose ground effect to be predicted based on theory for straight-line propagation but with reduced source height. At high frequencies upwind noise attenuation seems to be determined by 'shadow-zone' formation. We did not find an accurate way to predict noise levels in the shadow zone but we do not consider this a serious drawback for practical prediction work. To be useful in practical prediction a set of simple formulas for octave band calculations should be developed based on the theory. (au) 15 refs.

21148 (RISO-R–773(EN)) **Experimental determination of stiffness distributions and mode shapes of wind turbines blades.** Larsen, G.C.; Kretz, A. Risoe National Lab., Roskilde (Denmark). Test Station for Wind Turbines. Mar 1995. 59p. Contract ENS-5332/93-0001. Order Number DE95779206. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

Two non-destructive experimental methods, related to the structural properties of wind turbine blades, have been formulated and applied to two different blades. The first method deals with determination of the flexural rigidities of wind turbine blades and is based on static deflection measurements. The procedure has been applied to determine distribution of flapwise- and edgewise flexural rigidities of the LM17 m and the LM19 m blade. The findings have been compared to results obtained from cross section calculations, and the overall agreement between measured and calculated flexural rigidities is good, except for the edgewise rigidities related to the LM19 m blade, where some deviations are observed. The reason for this disagreement is believed to be a poor resolution of the curvature in the root part of the blade due to a seemingly hinge like edgewise deformation mechanism here. The second method deals with the determination of blade mode shapes. The method is founded on an experimental determination of the transfer function relating a dynamic loading with the corresponding acceleration response in a suitable number of points along the structure. The method has successfully been used to determine the first flapwise and edgewise natural modes of the LM17 m blade, and natural modes of the Lm19 m blade related of the first flapwise-, the second flapwise-, and the first edgewise natural frequency. (au) (13 tabs., 28 ills., 4 refs.)

21149 (RISO-R–799(EN)) **A design study of a 1 MW stall regulated rotor.** Fuglsang, P.L.; Madsen, H.Aa. Risoe National Lab., Roskilde (Denmark). Test Station for Wind Turbines. May 1995. 108p. Contract ENS-1363/95-0001; Contract ENS-1363/94-0001; Contract E Order Number DE95787780. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

EFP-95; EFP-94; EFP-91.

The main objective of the present work has been to design a 1 MW stall regulated rotor and investigate the potential improvements by using special tailored airfoils. The target rotor should have an improved cost performance compared to existing rotors. Cost performance is the annual production of energy seen relative to the material consumption. A newly developed numerical optimization tool and an aeroelastic code have been used in the study. Design parameters have been the blade chord, twist, tip pitch angle, angular velocity and airfoil characteristics. The objective function for the optimization has been the annual production of energy in the Danish roughness class 1. Constraints have been put on mean and extreme blade root flapwise moments, rated power, tip speed and blade geometry. By performing aeroelastic calculations on the optimized designs with different levels of constraints on the mean blade root flapwise moments, an almost linear correlation between the mean blade root flapwise moment and the equivalent fatigue loads appears. The optimum ratio of rated power to swept area appears to be around 400 W/m^2 having the mean flapwise blade root moment constrained to 80%. The maximum annual production of energy has been obtained for the airfoil section maximum lift coefficient, C_{Lmax}, being high over the entire blade independent on constrained loads. The direct improvement from the use of special tailored airfoils has been found to be around 4% on the annual energy production and 1.5% on the material consumption. When the entire rotor geometry is included as optimization variables, the choice of C_{Lmax} becomes less important since the design space is flat in the neighbourhood of the optimum. The results indicate a potential improvement of the cost performance of about 11% of which 5.5% can be achieved with the use of traditional airfoils. (Abstract Truncated)

21150 (SAND–94-2604C) **All wind farm uncertainty is not the same: The economics of common versus independent causes.** Veers, P.S. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950309–7: 25. annual conference and exhibition on wind power, Washington, DC (United States), 26-30 Mar 1995). Order Number DE95011894. Source: OSTI; NTIS; INIS; GPO Dep.

There is uncertainty in the performance of wind energy installations due to unknowns in the local wind environment, machine response to the environment, and the durability of materials. Some of the unknowns are inherently independent from machine to machine while other uncertainties are common to the entire fleet equally. The FAROW computer software for fatigue and reliability of wind turbines is used to calculate the probability of component failure due to a combination of all sources of uncertainty. Although the total probability of component failure due to all effects is sometimes interpreted as the percentage of components likely to fail, this perception is often far from correct. Different amounts of common versus independent uncertainty are reflected in economic risk due to either high probabilities that a small percentage of the fleet will experience problems or low probabilities that the entire fleet will have problems. The average, or expected cost is the same as would be calculated by combining all sources of uncertainty, but

the risk to the fleet may be quite different in nature. Present values of replacement costs are compared for two examples reflecting different stages in the design and development process. Results emphasize that an engineering effort to test and evaluate the design assumptions is necessary to advance a design from the high uncertainty of the conceptual stages to the lower uncertainty of a well engineered and tested machine.

1707 Health and Safety

21151 (NREL/SP–441-7814) **Proceedings of National Avian-Wind Power Planning Meeting, Lakewood, Colorado, July 20-21, 1994.** National Renewable Energy Lab., Golden, CO (United States). Apr 1995. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-9407179–: National Avian-wind power planning meeting, Lakewood, CA (United States), 20-21 Jul 1994). Order Number DE95004090. Source: OSTI; NTIS; GPO Dep.

In recent years, bird deaths in wind power plants within the United States have become an important issue with economic, legal, policy and research dimensions. The National Avian-Wind Power Planning Meeting was convened to focus on the research aspects, particularly to (1) identify and prioritize key issues with respect to bird-wind turbine interactions, (2) define a research agenda to resolve scientific and technical issues, while (3) insuring transferability of results, (4) avoiding duplication and inadequate science, and (5) building consensus on approaches to the research needed to address the issues. About 57 individuals plus various independent scientists with relevant expertise, met in Lakewood, Colorado, on 20-21 July 1994. They reviewed the status of wind power in the USA; developed lists of research questions; reviewed past and ongoing avian research at wind plants in the USA and Europe; discussed general design concepts for avian-wind power research, including both monitoring methods and the Adaptive Resource Management approach; discussed desirable components of an integrated national research program; and identified next steps that should be taken. The meeting Proceedings volume includes a Meeting Summary section covering each of the above topics, plus a more detailed description of the presentations, discussions and conclusions on each topic. Meeting attendees recommended that some of the technical issues identified at this meeting be taken up by a group with broader representation and mandate, including the economic, policy and legal ramifications. The National Wind Coordinating Committee's Avian Subcommittee may be an appropriate group to carry forward the work begun at this meeting. The overall goal might be to devise a process, incorporating scientific research as a major element, that would allow the wind industry to develop without the occurrence of an unacceptable number of bird deaths.

20 FOSSIL-FUELED POWER PLANTS

21152 (CONF-941089–Vol.1) **US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.** Harris, J.J. (USDOE Deputy Assistant Secretary, Washington, DC (United States). Office of Science and Technology Policy). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. 459p. Sponsored by USDOE, Washington, DC (United States). From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Volume 1 covers workshops on nuclear technologies and transmission and distribution. Separate abstracts were prepared for the 20 presentations included.

21153 (CONF-941089–Vol.2) **US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.** Chun, Sun W. (USDOE Pittsburgh Energy Technology Center, PA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. 607p. Sponsored by USDOE, Washington, DC (United States). From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Volume 2 covers workshops on environmental technology for the power sector and utility management, strategic planning, and joint marketing of power. Separate abstracts were prepared for the 23 papers included.

2001 Power Plants and Power Generation

Refer also to citation(s) 20535, 21071, 21075, 21076, 21169, 21172, 21385, 21523, 21828

21154 (DOE/MC/21023–3946) **Second Generation Pressurized Fluidized-Bed Combustion (PFBC). Phase 1, Task 4: Circulating PFB combustor, Test results.** Conn, R.; Robertson, A.; Van Hook, J.; Newby, R. Foster Wheeler Development Corp., Livingston, NJ (United States). Oct 1994. 620p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. Order Number DE95000039. Source: OSTI; NTIS; GPO Dep.

This pilot plant program confirmed the viability of the CPFBC (circulating pressurized fluidized-bed combustion) design and barrier candle filter from both operational and gaseous emissions standpoints. Several high volatile bituminous and one subbituminous coal were evaluated in addition to chars produced in the carbonizer pilot plant tests during Phase 2. Effects of combustor temperature, primary air stoichiometry, and excess air on combustor performance were evaluated. Carbon combustion efficiency were very high, exceeding 99% for all test coals and chars. CO emissions were very low compared to atmospheric CFB experience, <0.02 lb/10^6 Btu; it decreased by half when combustor temperature was increased from 1600 to 1700 F. Sulfur capture efficiencies >96% were achieved with sorbent addition rates of Ca/S ratios between 1.1 and 2.0. Because of the short height of the CPFBC, NO_x emissions were high but about half the NSPS requirements; primary air stoichiometry had the strongest effect. Also because of the short CPFBC height, Ca sulfide conversions were 74–82% for the char blends; higher sulfide conversions would be expected in a commerical-scale plant. Alkali concentrations were several times higher than the gas turbine limit, hence, an alkali getter will be required in a commercial plant. The barrier candle filter (14 Schumacher clay-bonded SiC candles) showed excellent performance for an extended test over 100 h with both coal and char firing.

21155 (DOE/MC/27363–3966) **Tampa Electric Company, Polk Power Station Unit No. 1, preliminary public design report.** Tampa Electric Co., FL (United States). Jun 1994. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-91MC27363. Order Number DE95000051. Source: OSTI; NTIS; GPO Dep.

This preliminary Public Design Report (PDR) provides design information about Tampa Electric Company's Polk Power Station Unit No. 1, which will demonstrate in a commercial 250 MW unit the benefits of the integration of oxygen-blown, entrained-flow coal gasification with advanced combined cycle technology. This project is partially funded by the US Department of Energy (DOE) under Round III of its Clean Coal Technology (CCT) Program under the provisions of Cooperative Agreement between DOE and Tampa Electric Company, novated on March 5,1992. The project is highlighted by the inclusion of a new hot gas cleanup system. DOE's project management is based at its Morgantown Energy Technology Center (METC) in West Virginia. This report is preliminary, and the information contained herein is subject to revision. Definitive information will be available in the final PDR, which will be published at the completion of detailed engineering.

21156 (DOE/MC/28065–4014) **Molten carbonate fuel cell (MCFC) product development test. Annual report, September 1993–September 1994.** M-C Power Corp., Burr Ridge, IL (United States). Feb 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC28065. Order Number DE95000084. Source: OSTI; NTIS; GPO Dep.

M-C Power Corporation will design, fabricate, install, test and evaluate a 250 kW Proof-of-Concept Molten Carbonate Fuel Cell (MCFC) Power Plant. The plant is to be located at the Naval Air Station Miramar in San Diego, California. This report summarizes the technical progress that has occurred in conjunction with this

project in 1994. M-C Power has completed the tape casting and sintering of cathodes and is proceeding with the tape casting and sintering of anodes for the first 250 cell stack. M-C Power and San Diego Gas and Electric relocated the fuel cell demonstration project to an alternate site at the Naval Air Station Miramar. For the new project location at the Naval Air Station Miramar, an Environmental Assessment has been prepared by the Department of Energy in compliance with the National Environmental Policy Act of 1969. The Environmental Assessment resulted in a categorical exclusion of the proposed action from all environmental permit requirements. Bechtel Corporation has completed the reformer process design coordination, a Process Description, the Pipe and Instrumentation Diagrams, a Design Criteria Document and General Project Requirement Document. Bechtel developed the requirements for soils investigation report and issued the following equipment bid packages to the suppliers for bids: Inverter, Reformer, Desulfurization Vessels, Hot Gas Recycle Blower, Heat Recovery Steam Generator, and Recycle Gas Cooler. SDG and E has secured necessary site permits, conducted soils investigations, and is working on the construction plan. They are in final negotiations with the US Navy on a site agreement. Site drawings are required for finalization of the agreement.

21157 (DOE/MC/30246–4022) **Advanced turbine systems program conceptual design and product development. Quarterly report, August–October, 1994.** Solar Turbines, Inc., San Diego, CA (United States). Jan 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC30246. Order Number DE95000092. Source: OSTI; NTIS; GPO Dep.

The objective of Phase 2 of the Advanced Turbine Systems (ATS) Program is to provide the conceptual design and product development plan for an ultra-high efficiency, environmentally superior and cost competitive industrial gas turbine system to be commercialized by the year 2000. A secondary objective is to begin early development of technologies critical to the success of ATS. During this report period, the following tasks were completed: Market study; System definition and analysis; and Integrated program plans. Progress on Task 8, Design and Test of Critical Components, is also discussed. This particular task includes expanded materials and component research covering recuperators, combustion, autothermal fuel reformation, ceramics application and advanced gas turbine system controls.

21158 (ETDE-DE–131) **Hydrogen/oxygen sudden reserve facility for fast power increase of steam power plants with integrated H_2O_2 steam generator, HYDROSS. Final report phase C. Vol. 1.** Fichtner Development Engineering GmbH, Stuttgart (Germany). 15 Nov 1994. 260p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0326544B. Order Number DE95785864. Source: OSTI; NTIS (US Sales Only).

Loose-leaf edition.

In the electricity supply grid of Western Europe, the supraregional utilities have agreed to provide a so-called primary reserve, which serves to maintain a rated frequency of 50 Hz. Imbalances between the generated and consumed electricity will cause frequency variations as electricity grids in general have low storage capacities. In the Western European interconnected grid, variations up to 150 mHz may occur. There are great differences in the annual incidence of negative variations from the rated frequency of 50 Hz. For example, there were about 4000 hours of variations with frequencies of less than 50 mHz but only about 260 hours of higher variations. Fast unit control possibilities - so-called sudden reserves - are required to remedy these negative deviations within a few seconds. The project intended to prove that the H_2O_2 steam generator combined with an efficient control concept can meet the demands on primary reserve and also the specifications of the DVG including high availability and reliability of starting. (orig.)

21159 (ETDE-DE–132) **Hydrogen/oxygen sudden reserve facility for fast power increase of steam power plants with integrated H_2O_2 steam generator, HYDROSS. Final report phase C. Vol. 2.** Fichtner Development Engineering GmbH, Stuttgart (Germany). 22 Nov 1994. 299p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0326544B. Order Number DE95785863. Source: OSTI; NTIS (US Sales Only).

Loose-leaf edition.

In the electricity supply grid of Western Europe, the supraregional utilities have agreed to provide a so-called primary reserve, which serves to maintain a rated frequency of 50 Hz. Imbalances between the generated and consumed electricity will cause frequency variations as electricity grids in general have low storage capacities. In the Western European interconnected grid, variations up to 150 mHz may occur. There are great differences in the annual incidence of negative variations from the rated frequency of 50 Hz. For example, there were about 4000 hours of variations with frequencies of less than 50 mHz but only about 260 hours of higher variations. Fast unit control possibilities - so-called sudden reserves - are required to remedy these negative deviations within a few seconds. The project intended to prove that the H_2O_2 steam generator combined with an efficient control concept can meet the demands on primary reserve and also the specifications of the DVG including high availability and reliability of starting. (orig.)

21160 (NEI-DK–2037) **Technical data on plants producing heat and electric power.** Energistyrelsen, Copenhagen (Denmark). May 1995. 89p. (In Danish). Order Number DE95787799. Source: OSTI; NTIS.

The publication comprises a revision and updating of the background report no.3 (1993) to Energy 2000, a document concerned with Danish energy and environmental policies, - Evaluation of technologies for electricity and power production. It also contains information on district heating technologies. (AB)

2002 Waste Management

Refer also to citation(s) 20574, 20575, 20587, 20592, 21154, 21352, 21385

21161 (ANL/ES/CP–84453) **Development of mercury control techniques for utility boilers.** Livengood, C.D.; Mendelsohn, M.H.; Huang, H.S.; Wu, J.M. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950646–22: Air and Waste Management Association meeting, San Antonio, TX (United States), 18-23 Jun 1995). Order Number DE95013517. Source: OSTI; NTIS; GPO Dep.

This paper gives an overview of research being conducted at Argonne National Laboratory on the capture of mercury in flue gas by both dry sorbents and wet scrubbers. The emphasis in the research is on development of a better understanding of the key factors that control the capture of mercury. Future work is expected to utilize that information for the development of new or modified process concepts featuring enhanced mercury capture capabilities.

21162 (CONF-9410328–1) **Ocean disposal of CO_2 at intermediate depths.** Adams, E.E.; Golomb, D.S.; Herzog, H.J. Massachusetts Inst. of Tech., Cambridge, MA (United States). Energy Lab. [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94227. From Workshop on CO_2 ocean disposal; Tokyo (Japan); 28 Oct 1994. Order Number DE95010507. Source: OSTI; NTIS; GPO Dep.

One option to reduce atmospheric CO_2 levels is to capture and sequester power plant CO_2. Commercial CO_2 capture technology, though expensive, exists today. However, the ability to dispose of large quantities of CO_2 is highly uncertain. The deep ocean is one of only a few possible CO_2 disposal options and is a prime candidate because the deep ocean is vast and highly unsaturated in CO_2. The term disposal is really a misnomer because the atmosphere and ocean eventually equilibrate on a timescale of 1,000 years regardless of where the CO_2 is originally discharged. However, peak atmospheric CO_2 concentrations expected to occur in the next few centuries could be significantly reduced by ocean disposal. From ocean scale mathematical models which compare the impact of releasing fossil-fuel CO_2 into the ocean at various depths, the authors conclude that a sequestration depth of about 1,000 m is required to achieve desired residence times on the order of hundreds of years. Below they summarize several modes of

CO_2 injection which have been identified in the literature. They conclude that the most feasible initial options will involve a release of liquid CO_2 at intermediate depths of 1,000 to 1,500 m. Either an unconfined release leading to a buoyant droplet plume or a confined release leading to a dense CO_2-seawater solution would work. The intermediate discharge depth represents a compromise between the depth of ultimate sequestration, current engineering technology and national jurisdiction limits. They outline steps toward implementation of these options, including needed studies on injector design, transport and costs, site selection and environmental and legal considerations.

21163 (DOE/MC/22118–3969) **Field study for disposal of solid wastes from Advanced Coal Processes: Ohio LIMB Site Assessment. Final report, April 1986–November 1994.** Weinberg, A.; Coel, B.J.; Butler, R.D. Radian Corp., Austin, TX (United States). Oct 1994. 671p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC22118. Order Number DE95000053. Source: OSTI; NTIS; GPO Dep.

New air pollution regulations will require cleaner, more efficient processes for converting coal to electricity, producing solid byproducts or wastes that differ from conventional pulverized-coal combustion ash. Large scale landfill test cells containing byproducts were built at 3 sites and are to be monitored over at least 3 years. This report presents results of a 3-y field test at an ash disposal site in northern Ohio; the field test used ash from a combined lime injection-multistage burner (LIMB) retrofit at the Ohio Edison Edgewater plant. The landfill test cells used LIMB ash wetted only to control dusting in one cell, and LIMB ash wetted to optimize compaction density in the other cell. Both test cells had adequate load-bearing strength for landfill stability but had continuing dimensional instability. Heaving and expansion did not affect the landfill stability but probably contributed to greater permeability to infiltrating water. Leachate migration occurred from the base, but effects on downgradient groundwater were limited to increased chloride concentration in one well. Compressive strength of landfilled ash was adequate to support equipment, although permeability was higher and strength was lower than anticipated. Average moisture content has increased to about 90% (dry weight basis). Significant water infiltration has occurred; the model suggests that as much as 20% of the incident rainfall will pass through and exit as leachate. However, impacts on shallow ground water is minimal. Results of this field study suggest that LIMB ash from combustion of moderate to high sulfur coals will perform acceptably if engineering controls are used to condition and compact the materials, reduce water influx to the landfill, and minimize leachate production. Handling of the ash did not pose serious problems during cell construction; steaming and heat buildup were moderate.

21164 (DOE/PC/90366–T13) **Characterization of air toxics from a laboratory coal-fired combustor and utility scale power plants. Quarterly progress report No. 14, January–March, 1995.** Battelle, Columbus, OH (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90366. Order Number DE95011920. Source: OSTI; NTIS; GPO Dep.

This report summarized progress on Task 3, Power Plant Studies, and Task 4, Technical Management and Reporting. Task 3 this quarter involved sampling of flue gas from Units 6 and 7 of the host power plant. The operating parameters during the sampling period are given. Laboratory analyses are in progress. Under Task 4, internal and external QA/QC audits were conducted. A data base management system was prepared. An appendix contains a data compilation of plant operating data.

21165 (DOE/PC/90367–T13) **Sampling of power plant stacks for air toxic emissions: Topical report for Phases 1 and 2.** Radian Corp., Austin, TX (United States). 21 Feb 1995. 341p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC90367. (DCN–95-209-057-05). Order Number DE95011466. Source: OSTI; NTIS; GPO Dep.

Under contract with the US Department of Energy (DE-AC22-92PCO0367), Pittsburgh Energy Technology Center, Radian Corporation has conducted a test program to collect and analyze size-fractionated stack gas particulate samples for selected inorganic hazardous air pollutants (HAPS). Specific goals of the program are (1) the collection of one-gram quantities of size-fractionated stack gas particulate matter for bulk (total) and surface chemical charactization, and (2) the determination of the relationship between particle size, bulk and surface (leachable) composition, and unit load. The information obtained from this program identifies the effects of unit load, particle size, and wet FGD system operation on the relative toxicological effects of exposure to particulate emissions.

21166 (DOE/PC/93254–T1) **Characterizing toxic emissions from a coal-fired power plant demonstrating the AFGD ICCT Project and a plant utilizing a dry scrubber/baghouse system: Bailly Station Units 7 and 8 and AFGD ICCT Project. Final report. Final report.** Dismukes, E.B. Southern Research Inst., Birmingham, AL (United States). 20 Oct 1994. 889p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93PC93254. (SRI-ENV–94-287-7960). Order Number DE95005662. Source: OSTI; NTIS; GPO Dep.

This report describes results of assessment of the risk of emissions of hazardous air pollutants at one of the electric power stations, Bailly Station, which is also the site of a Clean Coal Technology project demonstrating the Pure Air Advanced Flue Gas Desulfurization process (wet limestone). This station represents the configuration of no NO_x reduction, particulate control with electrostatic precipitators, and SO_2 control with a wet scrubber. The test was conducted September 3–6, 1993. Sixteen trace metals were determined along with 5 major metals. Other inorganic substances and organic compounds were also determined.

21167 (NEI-DK–1988) **Optimized construction and use of flue-gas heat exchangers in the large natural gas-fueled boilers.** Energiministeriets Forskningsudvalg for produktion og fordeling af el og varme. Miljoe og restprodukter. Krueger (I.) A/S, Copenhagen (Denmark); Dansk Teknologisk Inst., Taastrup (Denmark). Apr 1995. 111p. (In Danish). Contract EM-1433/86-14. Order Number DE95779161. Source: OSTI; NTIS.

EFP-86.

The Danish Technological Institute and I. Krueger AS have cooperated in developing computer programmes, COHEX and MODS, to compute condensing flue gas coolers. The computer programmes focus on the computation of crossflow/counterflow heat exchangers, but are able to handle other configurations - especially COHEX. The computer program computes performance and temperature data, amount of condensate and pressure loss in connection with complete or partial condensing flue gas cooling. Through laboratory tests it has been demonstrated that the measured values are in agreement with the computed values within an average uncertainty margin of +/- 10% with regard to the determination of heat transfer coefficient. For practical use this result is considered as satisfactory. (au) (30 refs.)

2004 Health and Safety

Refer also to citation(s) 20598

21168 (BNL–61542) **Issues in the assessment of congenital health risks from mercury in coal.** Lipfert, F.W. (Brookhaven National Lab., Upton, NY (United States)); Moskowitz, P.D.; Saroff, L. Brookhaven National Lab., Upton, NY (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950646–12: Air and Waste Management Association meeting, San Antonio, TX (United States), 18-23 Jun 1995). Order Number DE95009043. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a probabilistic assessment of congenital neurological risks associated with consumption of fish and shellfish containing MeHg and the effects that local coal combustion might have on those risks. Two scenarios were considered with this model: the "baseline" scenario (MeHg from fish consumption without local impacts), and the "impact" scenario (baseline plus local power-plant impact on freshwater fish). In this paper, we describe the framework and application of the model, including parameters and statistical linkages, the distributions used to represent the parameters, and the statistical methods used to characterize the inherent variability in each individual's diet and the distribution of

individuals within a hypothetical population. These factors define the baseline, which is then compared to observations of MeHg in hair in order to demonstrate the model's validity. The incremental effect of local coal combustion is represented by augmenting the distribution of Hg in local freshwater fish by a prescribed amount, which we refer to as the "impact factor." Conventional air pollution dispersion modeling is then used to relate this factor to an appropriate range of powerplant characteristics.

2005 Environmental Aspects

Refer also to citation(s) 21168

21169 (DOE/EIS–0215-Vol.1) **Final environmental impact statement for the proposed Pinon Pine Power Project, Tracy Station, Nevada. Volume 1.** USDOE, Washington, DC (United States). Sep 1994. 448p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012137. Source: OSTI; NTIS; INIS; GPO Dep.

Pinon Pine, a proposed 104 MW (gross) demonstration project at Sierra Pacific's Tracy Power Station 17 miles east of Reno NV, would demonstrate Integrated Gasification Combined Cycle for converting coal into clean gas, burning the gas in a combustion turbine to generate electric power, and capturing the heat to drive a steam turbine for additional power. It would use the KRW fluidized-bed gasification process and would also demonstrate the effectiveness of hot gas cleanup. Environmental impacts from Pinon Pine construction are evaluated in this FEIS: detailed analyses are made on air quality, water quality and quantity, the endangered Cui-ui fish species, disposal of spent limestone and coal ash, noise, land use, aesthetics, cultural resources, socioeconomic resources, etc. Mitigation measures are discussed.

21170 (DOE/EIS–0215-Vol.2) **Final Environmental Impact Statement for the proposed Pinon Pine Power Project, Tracy Station, Nevada: Volume 2, Appendices.** USDOE Morgantown Energy Technology Center, WV (United States). Sep 1994. 420p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012138. Source: OSTI; NTIS; INIS; GPO Dep.

Appendices are included which cover the assessment methodology, agency coordination letters, the visibility impact analysis, water consumption, groundwater quality, reading rooms, comments submitted on the Draft Environmental Impact Statement, and responses to comments.

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 21425, 21431

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

Refer also to citation(s) 21152, 21211

21171 (CEA-CONF–11971) **Civil plutonium amounts in the world.** Naudet, G. CEA, 75 - Paris (France). 1994. 10p. (In French). (CONF-9406338–: Colloquium on plutonium: a new nuclear fuel, Paris (France), 9 Jun 1994). Order Number DE95631360. Source: OSTI; NTIS (US Sales Only); INIS.

The experience of plutonium reprocessing in water reactors is positive and today the use of this nuclear fuel is at industrial level. Plutonium quantities in spent fuel go on increasing, plutonium stock coming from reprocessing can be controlled: according to conjuncture, it will evolve by stabilization or decreasing at the beginning of next century.

21172 (EPRI–95011538) **Electric Power Research Institute: To discover, to develop, to deliver. 1992 Annual report.** Electric Power Research Inst., Palo Alto, CA (United States). [1993]. 40p. Sponsored by Electric Power Research Inst., Palo Alto, CA (United States). Source: OSTI; EPRI Distribution Center, 207 Coggins Drive, PO Box 23205, Pleasant Hill, CA 94523 (United States); INIS.

This report highlights the winners of the 1992 3-D Awards and surveys other Institute accomplishments in discovery, development, and delivery for the year – achievements that exemplify EPRI's ability to fulfill the promise of its mission.

21173 (FAAR–23/1993, pp. 284-289) **PVC smoke and CsI aerosol mixture in moist atmosphere. An experimental study.** Surakka, J. (Kuopio Univ. (Finland). Dept. of Environmental Sciences. Lab. for Atmospheric Physics and Chemistry). Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

The mixture of hygroscopic CsI aerosol simulating nuclear aerosol and smoke from PVC cable fire were studied in a small scale reactor chamber. The atmosphere in the chamber represents the post-accident situations in nuclear reactor or reactor containment area. Changes with time in mixture aerosols were measured by optical particle counter (OPC). The aim of these experiments was to study experimentally the effect of PVC cable smoke and hygroscopic CsI aerosol mixture to humidity level in the reactor chamber. (12 refs., 4 figs.).

21174 (IAEA-TECDOC–797) **OSART mission highlights 1991-1992. Operational safety practices in nuclear power plants.** International Atomic Energy Agency, Vienna (Austria). May 1995. 83p. Order Number DE95633550. Source: OSTI; NTIS (US Sales Only); INIS.

This report continues the practice of providing summaries of the OSART missions but the format is the first of its kind. Summaries of missions in the period 1983-1990 have covered missions to operational plants, missions to plants under construction or approaching commissioning and a compilation of good practices identified in OSART missions as separate publications. The format of this report includes all such aspects in one document.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 21186, 21212, 21217, 21238, 21254, 21256, 21258, 21303, 21313, 21314, 21317, 21587

21175 (FAAR–23/1993, pp. 249-255) **Numerical simulation of aerosol transport during HDR fire experiments.** Fischer, K. (Battelle Ingenieurtechnik GmbH, Frankfurt am Main (Germany)); Woersdoerfer, K. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

In the framework of the HDR program on nuclear reactor safety, several containment fire experiments were performed over the last years in realistic multi-compartment geometries with realistic fire loads originating from burning cables. The major objective was to evaluate and to assess the predictive quality of present computational tools for fire calculations. In the present paper, numerical simulations of two oil fire tests and one cable fire experiment are presented, with special emphasis regarding aerosol transport. The fire aerosols (smoke) have to be taken into account when considering the availability of rescue pathways for the operating personnel and the capacity of filters in the ventilation system. In case of severe accidents, interactions of smoke with radioactive aerosols may be of importance. (5 refs., 10 figs.).

21176 (FAAR–23/1993, pp. 256-266) **KAEVER: experiments on an improved understanding of aerosol behaviour in reactor containments.** Scheibel, H.G. (Battelle Ingenieurtechnik GmbH, Frankfurt am Main (Germany)); Poss, G.; Weber, D. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium,

Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

KAEVER is an experimental program to investigate the influences of size distribution, morphology, composition and solubility on the aerosol behaviour under various thermohydraulic conditions simulating the accident situation in LWR-containments. The KAEVER facility consists of a 10 m^3 containment vessel, an aerosol generation system with two independent inductive furnaces and a sophisticated aerosol instrumentation. The research program includes experiments to the generation of single and multicomponent insoluble (SnO_2, Ag) and soluble (CsOH, CsI, NaCl) core melt aerosol simulants and investigates the aerosol agglomeration and deposition behaviour in the containment vessel under various thermohydraulic conditions. The experiments are supported by thermohydraulic and aerosol codes. The applied aerosol measurement equipment i.e. an aerosol photometer, a differential mobility analyzer, low pressure impactors, an optical particle counter, an aerodynamic particle sizer and filtration and deposition devices, provides data on particle size distribution, shape, concentration, and on the elemental composition. Particle size ranges from 0.01 μm up to 50 μm. (orig.) (6 refs., 1 fig., 1 tab.).

21177 (FAAR–23/1993, pp. 265-268) **Chemical speciation of aerosols formed from heated LWR fuel and control rod simulants.** Beard, A.M. (AEA Technology, Dorchester (United Kingdom). Reactor Chemistry Dept.); Bennet, P.J.; Bowsher, B.R.; Brunning, J.; Kauppinen, E.I.; Lind, T.M.; Jokiniemi, J.K.; Maekynen, J.M. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

At Winfrith the Falcon facility has been used to study fission product vapour release and aerosol formation from simulant and trace irradiated fuel and control rod samples, however these releases could not be observed in real time. Vapour release and aerosol formation from heated LWR fuel and control rod simulants have been studied as a function of time in the modified Falcon facility using a range of on-line aerosol sampling equipment. Various post test analytical techniques have been used to characterise the resulting chemical species and the particle physical characteristics. A companion paper describes the aerosol formation and release rates from the simulants, whilst the results of the chemical and physical analyses are described. (2 refs.).

21178 (FAAR–23/1993, pp. 269-273) **Experimental studies on aerosol behaviour in LWR containment conditions.** Maekynen, J.M. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Jokiniemi, J.K.; Silde, A.; Kauppinen, E.I.; Kervinen, H. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

AHMED (Aerosol and Heat Transfer Measurement Device) has been constructed to study thermal-hydraulic effects on aerosol behaviour in nuclear power station containment during a hypothetical severe reactor accident where the reactor core melts and releases radioactive aerosols into containment. The objective of the work is to understand the reasons for observed large discrepancies between the results from model calculations and measurements carried out in large scale experiments (aerosol modelling, uncertainties in thermal-hydraulic conditions or measurements errors). (2 refs., 5 figs.).

21179 (JAERI-Research–95-013) **Behavior of pre-irradiated fuel under a simulated RIA condition. Results of NSRR test JM-4.** Fuketa, Toyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Mori, Yukihide; Sasajima, Hideo; Tanzawa, Sadamitsu; Ishijima, Kiyomi; Kobayashi, Shinsho; Kikuchi, Teruo; Homma, Kozo; Sakai, Haruyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 238p. Order Number DE95780630. Source: OSTI; NTIS; INIS.

This report presents results from the power burst experiment with pre-irradiated fuel rod, Test JM-4, conducted in the Nuclear Safety Research Reactor (NSRR). The data concerning test method, pre-irradiation, pre-pulse fuel examination, pulse irradiation, transient records and post-pulse fuel examination are described, and interpretations and discussions of the results are presented. Preceding to the pulse irradiation in the NSRR, test fuel rod was irradiated in the Japan Materials Testing Reactor (JMTR) up to a fuel burnup of 21.2 MWd/kgU with average linear heat rate of 27.5 kW/m. The fuel rod was subjected to the pulse irradiation resulting in a deposited energy of 235 $\pm$ 12 cal/g · fuel and a peak fuel enthalpy of 177 $\pm$ 9 cal/g · fuel under stagnant water cooling condition at atmospheric pressure and ambient temperature. Test fuel rod behavior was assessed from pre- and post-pulse fuel examinations and transient records during the pulse. The Test JM-4 became the first NSRR pre-irradiated fuel experiment resulting in fuel failure. The cladding surface temperature increased to 780degC, and the test resulted in fuel failure with considerable rod diameter increase and rod bending. The test results indicate that number of wall through defects are generated by intensive PCMI (pellet/cladding mechanical interaction) and local hydriding of cladding tube. Significant separation of grain boundaries was observed in extensive area of fuel pellets. (author).

21180 (NUREG–1433-Vol.3-Rev.1) **Standard Technical Specifications General Electric plants, BWR/4:Bases (Sections 3.4-3.10). Volume 3, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Project Support. Apr 1995. 415p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for General Electric BWR/4 Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the specifications for all chapters and sections of the improved STS. Volume 2 contains he Bases for Chapters 2.0 and 3.0, and Sections 3.1-3.3 of the improved STS. This document, Volume 3, contains the Bases for Sections 3.4-3.10 of the improved STS.

21181 (NUREG–1434-Vol.3-Rev.1) **Standard Technical Specifications General Electric plants, BWR/6: Bases (Sections 3.4-3.10). Volume 3, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Project Support. Apr 1995. 434p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for General Electric BWR/6 Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the

Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1-3.3 of the improved STS. This document, Volume 3 contains the Bases for Sections 3.4-3.10 of the improved STS.

21182 (NUREG/CP–0139, pp. 13-14) **Key results from the NRC's short cracks in piping and piping welds research program.** Wilkowski, G. (Battelle, Columbus, OH (United States)); Krishnaswamy, P.; Brust, F.; Francini, R.; Ghadiali, N.; Held, P.; Kilinski, T.; Mohan, R.; Marschall, C.; Rahman, S. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1994. (CONF-9410216–: 22. water reactor safety information meeting, Bethesda, MD (United States), 24-26 Oct 1994). In *Transactions of the twenty-second water reactor safety information meeting.* 129p. Source: OSTI; NTIS; INIS.

The overall objective of this program is to verify and improve engineering analyses to predict the fracture behavior of circumferentially cracked pipe under quasi-static loading. Particular attention is paid to crack lengths typically used in LBB or flaw evaluation criteria. This program started in march 1990 and is in its' final year. This paper reflects progress made in the 9 tasks since the last WRSIM meeting as well as our conclusions to date.

21183 (NUREG/CP–0139, pp. 57-58) **Methods for evaluating nontypical gate valve thrust requirements.** Steele, R. Jr. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Watkins, J.C.; DeWall, K.G.; Weidenhamer, G.H. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1994. (CONF-9410216–: 22. water reactor safety information meeting, Bethesda, MD (United States), 24-26 Oct 1994). In *Transactions of the twenty-second water reactor safety information meeting.* 129p. Source: OSTI; NTIS; INIS.

Evaluating rising stem wedge type gate valves is not a problem when the valves can be design-basis tested and their operability margins determined diagnostically. The problem occurs when they cannot be tested because of system limitations or when they can be tested only at some less-than-design-basis condition. To evaluate these valves requires various analytical methods by which the design-basis stem thrust requirement can be determined. This is typically done with valve stem thrust force models that are used to calculate the requirements or to extrapolate the results from less than a design-basis test. The stem thrust models used by the nuclear industry to determine the opening or closing stem thrust requirements for these gate valves have generally assumed that the highest load the valve experiences during closure (but before seating) is at flow isolation and during unwedging or before flow initiation in the opening direction. However, during full-scale valve testing conducted for the USNRC, several of the valves produced stem thrust histories that showed peak closing stem forces occurring before flow isolation in the closing direction and after flow initiation in the opening direction. All of the valves that exhibited this behavior in the closing direction also showed signs of internal damage. Initially, we dismissed the early peak in the closing stem thrust requirement as damage-induced and labeled it nonpredictable behavior.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 20770, 21059, 21176, 21177, 21178, 21179, 21182, 21183, 21212, 21214, 21254, 21255, 21292, 21293, 21303, 21307, 21308, 21313, 21314, 21315, 21587, 21760, 21761, 21762, 21763, 22934

21184 (EDF–94-NB-00091) **"PSAD" on-line monitoring and aid to diagnosis workstation: a monitoring tool for EDF power plants.** Morel, J.; Mazalerat, J.M.; Monnier, B.; Cordier, R. Electricite de France (EDF), 92 - Clamart (France). 1993. 8p. (In French). Order Number DE95631405. Source: OSTI; NTIS (US Sales Only); INIS.

Like other electricity utilities, Electricite de France seeks to enhance the safety and availability of its nuclear power plants. To this end, for over ten years EDF has been installing on each plant unit two monitoring systems of its own design, one to monitor the primary cooling system, and the other, the turbogenerator set. Since the beginning of this project, widespread progress has been made in techniques of signal acquisition and processing, and in diagnosis using artificial intelligence methods. EDF has decided to call on these advanced techniques in developing its new-generation monitoring equipment, and to integrate them in its development of a workstation for on-line monitoring and diagnosis-support (PSAD: Poste de Surveillance et d'Aide au Diagnostic). PSAD will be a tool for on-line monitoring of the main components in nuclear power plants (initially the main coolant pumps and turbogenerator sets, and soon thereafter, monitoring of internal structures, detection of loose parts in the primary cooling system, etc.). PSAD will provide plant personnel with indispensable support in their diagnosis of the condition of plant equipment. It will integrate user-friendly, high-performance systems that also free the operator from many day-to-day tasks. PSAD will have a flexible architecture, for optimum distribution of the computing power where it is most needed, thereby improving the quality of the data. This paper presents the project objectives and describes work currently under way to implement EDF's diagnosis-support strategy for the years to come. (authors). 5 figs., 6 refs.

21185 (EDF–94-NB-00095) **Preliminary vibration analysis of the prestressed tie rods attaching the Paluel-4 main steam line No.1 stops to the concrete structures.** Guihot, P.; Chartain, G.; Coudiere, F. Electricite de France (EDF), 92 - Clamart (France). Nov 1993. 43p. (In French). Order Number DE95631407. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents results of vibration analysis of prestressed tie rods attaching the main steam system stops on Paluel-4 line no 1. Reasons for this feasibility study and main results are summarized: During surface preparation for routine ultrasonic examination of the tie rods, a nut was found completely unscrewed. A systematic tightening procedure, using hydraulic devices, was immediately implemented. For about 1/3 of the 80 tie rods on the four live steam clamps, tension was below nominal. However, this checking procedure involves high costs. Until an explanation has been found, other plant units will have to be checked and it is consequently important to find a less costly way of checking the tension, so that the hydraulic tightening equipment would only be used in cases where prestressing was inadequate. The R and D Acoustics and Vibration Mechanics branch proposed to analyze the vibratory signature of the tie rods to assess sensitivity of their dynamic response to prestressing variations. Purpose of the tests was to estimate the feasibility of the procedure, which could then be refined. If we consider theoretical results, we find that the first bending frequency for a beam in tension depends on the tension level. Unfortunately, with the hammer tests performed, we were unable to identify the first eigenfrequency of the tie rod. Other parameters measured would not appear to be directly related to the prestress level. Since checking the prestress condition had to be extended to other units, it seems appropriate to pursue these investigations with a view to determining the exact sensitivity of the vibratory and acoustic parameters to the level of prestressing applied. It would also seem important to improve test conditions so that the first eigenfrequencies of the tie rods can be identified. A sinusoidal sweeping test with an electrodynamic exciter could be used for any future tests which may be carried out. (authors). figs., tabs., 2 refs., 4 annexes.

21186 (FAAR–23/1993, pp. 274-277) **Aerosol formation and release rates from heated LWR fuel and control rod simulants.** Maekynen, J.M. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Jokiniemi, J.K.; Kauppinen, E.I.; Lind, T.M.; Bennett, P.J.; Beard, A.M.; Brunning, J.; Bowsher, B.R. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth*

Finnish national aerosol symposium. 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

Vapour release rates and aerosol formation from heated LWR fuel and control rod simulants have been studied in the modified Falcon test facility. The simulant fuel samples consisted of UO_2 pellets in Zircaloy cladding. The pellets contained 8.84 mg of CsI, 56.94 mg of CsOH, 10.64 mg of Te, 21.66 mg of SrO, 34.42 mg of BaO and 55.80 mg of Mo in 18.6 g of UO_2. The composition of the control rod samples was 1.3 g 80 per cent Ag-15 per cent In-5% Cd in sections of 8.75 mm diameter stainless steel cladding. (2 refs., 2 figs.).

21187 (FURNAS-DEN-N–021/91) **Application of a new cross section library based on ENDF/B-IV to reactor core analysis.** Lima Bezerra, J. de. FURNAS Centrais Eletricas S.A., Rio de Janeiro, RJ (Brazil). Dept. de Engenharia Nuclear. Apr 1991. 61p. (In Portuguese). Order Number DE95632442. Source: OSTI; NTIS (US Sales Only); INIS.

The use of the ENDF/B-IV library in the LEOPARD code for the Angra-1 reactor simulation is presented. The results are compared to those obtained using the ENDF/B-II library and show better values for the power distribution but an underestimated global reactivity as compared to experimental results. (F.E.). 1 ref, 55 figs, 1 tab.

21188 (FURNAS-DEN-N–029/91(Rev.1)) **Methodology for reactor core physics analysis - part 2.** Ponzoni Filho, P.; Fernandes, V.B.; Lima Bezerra, J. de; Santos, T.I.C. FURNAS Centrais Eletricas S.A., Rio de Janeiro, RJ (Brazil). Dept. de Engenharia Nuclear. Dec 1992. 53p. (In Portuguese). Order Number DE95632443. Source: OSTI; NTIS (US Sales Only); INIS.

The computer codes used for reactor core physics analysis are described. The modifications introduced in the public codes and the technical basis for the codes developed by the FURNAS utility are justified. An evaluation of the impact of these modifications on the parameter involved in qualifying the methodology is included. (F.E.). 5 ref, 7 figs, 5 tabs.

21189 (NUREG–1275-Vol.11) **Operating experience feedback report – turbine-generator overspeed protection systems: Commercial power reactors. Volume 11.** Ornstein, H.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Programs. Apr 1995. 115p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report presents the results of the US Nuclear Regulatory Commission's Office for Analysis and Evaluation of Operational Data (AEOD) review of operating experience of main turbine-generator overspeed and overspeed protection systems. It includes an indepth examination of the turbine overspeed event which occurred on November 9, 1991, at the Salem Unit 2 Nuclear Power Plant. It also provides information concerning actions taken by other utilities and the turbine manufacturers as a result of the Salem overspeed event. AEOD's study reviewed operating procedures and plant practices. It noted differences between turbine manufacturer designs and recommendations for operations, maintenance, and testing, and also identified significant variations in the manner that individual plants maintain and test their turbine overspeed protection systems. AEOD's study provides insight into the shortcomings in the design, operation, maintenance, testing, and human factors associated with turbine overspeed protection systems. Operating experience indicates that the frequency of turbine overspeed events is higher than previously thought and that the bases for demonstrating compliance with NRC's General Design Criterion (GDC) 4, Environmental and dynamic effects design bases, may be nonconservative with respect to the assumed frequency.

21190 (SAIC–94-6553) **Analysis of core damage frequency: Nuclear power plant Dukovany, VVER/440 V-213 Unit 1, internal events. Volume 1: Main report.** Pugila, W.J. Science Applications International Corp., San Diego, CA (United States). 21 Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States);International Atomic Energy Agency, Vienna (Austria);Government of the Czech Republic (Czech Republic). Order Number DE95012431. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the final results from the Level 1 probabilistic safety assessment (PSA) for the Dukovany VVER/440 V-213 nuclear power plant, Unit 1. Section 1.1 describes the objectives of this study. Section 1.2 discusses the approach that was used for completing the Dukovany PSA. Section 1.3 summarizes the results of the PSA. Section 1.4 provides a comparison of the results of the Dukovany PSA with the results of other PSAs for different types of reactors worldwide. Section 1.5 summarizes the conclusions of the Dukovany PSA.

2103 Power Reactors, Nonbreeding, Graphite Moderated

21191 (DOE/EA–0984) **Environmental assessment for the deactivation of the N Reactor facilities.** USDOE Richland Operations Office, WA (United States). May 1995. 136p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012124. Source: OSTI; NTIS; INIS; GPO Dep.

This environmental assessment (EA) provides information for the US Department of Energy (DOE) to decide whether the Proposed Action for the N Reactor facilities warrants a Finding of No Significant Impact or requires the preparation of an environmental impact statement (EIS). The EA describes current conditions at the N Reactor facilities, the need to take action at the facilities, the elements of the Proposed Action and alternatives, and the potential environmental impacts. As required by the National Environmental Policy Act of 1969 (NEPA), this EA complies with Title 40, Code of Federal Regulations (CFR), parts 1500–1508, "Regulations for Implementing the Procedural Provisions of NEPA. " It also implements the "National Environmental Policy Act; Implementing Procedures and Guidelines" (10 CFR 1021).

21192 (FAAR–23/1993, pp. 278-283) **Uranium fuel particles in a rbmk accident. Particle characteristics and atmospheric transport.** Poellaenen, R. (Finnish Centre for Radiation and Nuclear Safety, Helsinki (Finland)); Toivonen, H.; Salonoja, M.; Valkama, I. Finnish Association for Aerosol Research, Espoo (Finland); Technical Research Centre of Finland, Espoo (Finland). Aerosol Technology Group. 1993. (CONF-9306401–: 5. Finnish national aerosol symposium, Espoo (Finland), 1-3 Jun 1993). In *The fifth Finnish national aerosol symposium.* 292p. Order Number DE95632436. Source: OSTI; NTIS; INIS.

Report series in aerosol science.

In a severe nuclear accident large amounts of radioactive substances, either gases or particles, may be released to the atmosphere. Small particles ($> 1\ \mu m$), formed from the gaseous species by nucleation and condensation, are often almost monoelemental in nuclide composition. Mechanically fragmented nuclear fuel particles are larger and their nuclide composition is similar to the fuel. However, gaseous species are missing. The volatile elements, e.g. I and Cs, are depleted, either partially or totally. Particle transport from the site of accident depends strongly on weather conditions and particle properties. The radioactive plume can rise rapidly several hundreds or even thousands of meters above the ground. Small particles can stay in the atmosphere long periods of time provided that they are initially transported to the upper parts of the atmosphere. Large particles leave the main aerosol stream mainly by sedimentation. Therefore, the behaviour and the radiological consequences of the large particles is not described properly by assuming that the 'particle plume' is similarly mixed than the gaseous plume. Particle specific trajectory calculations are needed. Consequence analyses of severe accidents are often performed neglecting the particle nature of the release. The properties of the particles, however, have an important role in the possible radiological hazard that the radioactive substances may cause. Especially beta radiation from large particles can lead to high individual skin doses. (7 refs., 2 figs., 2 tabs.).

21193 (PNL–10613) **RBMK thermohydraulic safety assessments using RELAP5/MOD3 codes.** Tsiklauri, G.V.; Schmitt, B.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013853. Source: OSTI; NTIS; INIS; GPO Dep.

The capability of the RELAP5/MOD3 code to validate various transients encountered in RBMK reactor postulated accidents has been assessed. The assessment results include a loss of coolant accident at the inlet of the core pressure tube, the blockage of a pressure tube, and the pressure response of the core cavity to in core pressure tube ruptures. These assessments show that the RELAP5/MOD3 code can predict major phenomena during postulated accidents in the RBMK reactors.

2105 Power Reactors, Breeding

Refer also to citation(s) 21233, 21257

21194 (ANL/RA/CP–83070) **Assessment of the SE2-ANL code using EBR-II temperature measurements.** Yang, W.S.; Yacout, A.M. Argonne National Lab., IL (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950904–2: 7. international meeting on nuclear reactor thermal hydraulics, Saratoga, NY (United States), 10-15 Sep 1995). Order Number DE95004640. Source: OSTI; NTIS; INIS; GPO Dep.

The SE2-ANL code is a modified version of the SUPERENERGY-2 code [1]. This code is used at Argonne National Laboratory (ANL) to compute the core-wide temperature profiles in Liquid Metal Reactor (LMR) cores. The accuracy of this code has recently been tested by comparing the predicted temperatures with measured values in the Experimental Breeder Reactor R (EBR-II). The detailed temperature distributions in two experimental subassemblies and the mixed mean subassembly outlet temperatures were used in this validation study. The SE2-ANL predictions were found to agree well with measured values. It was also found that SE2-ANL yields results with accuracy comparable to the more detailed COBRA-WC [2] calculations at much lower computational cost.

21195 (FEI–2383) **The influence of the water chemistry regime of the third circuit on the corrosion hydrogen burden to the secondary sodium circuit in the steam generator model of BN-800 reactor.** Smykov, V.B.; Ermolaev, N.P.; Kolesnik, A.I.; Egorov, V.A.; Shevchenko, N.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 13p. (In Russian). Order Number DE95633613. Source: OSTI; NTIS (US Sales Only); INIS.

An experimental program was conducted to determine the influence of water chemistry on the corrosion hydrogen burden from the III circuit to the secondary sodium in sodium-heated rig of OTSG of NPP BN-800. Combined water chemistry has given the best passivative effect on steam-generating surfaces and smallest hydrogen burden to secondary sodium during start-up. Common hydrogen increasing in secondary sodium was less then 0.2 ppm. In case of AVT water chemistry (NH_3+N_2H_4) in III side of OTSG-rig the hydrogen level in secondary sodium was 1.0-1.2 ppm. It means that during first start-up at NPP BN-800 the common hydrogen level in secondary sodium may reaches 0.80-0.85 ppm. 4 figs.; 4 tabs.

21196 (IAEA-TECDOC–798) **Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.** International Atomic Energy Agency, Vienna (Austria). May 1995. 181p. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

The Research Co-ordination Meeting held in Vienna, 16-17 November 1993, was attended by participants from France, India, Italy, Japan and the Russian Federation. The meeting was held to discuss and compare the results obtained by various organizations for the analysis of Italian tests on PEC mock-up. The background paper by A. Martelli, et al., Italy, entitled Fluid-Structure Interaction Experiments of PEC Core Mock-ups and Numerical Analysis Performed by ENEA presented details on the Italian PEC (Prova Elementi di Combustibile, i.e. Fuel Element Test Facility) test data for the benchmark. Several papers were presented on the analytical investigations of the PEC reactor core experiments. The paper by M. Morishita, Japan, entitled Seismic Response Analysis of PEC Reactor Core Mock-up, gives a brief review of the Japanese data on the Monju mock-up core experiment which had been distributed to the participating countries through the IAEA. Refs, figs and tabs.

21197 (IAEA-TECDOC–798, pp. 13-51) **Fluid-structure interaction experiments of PEC core mock-ups and numerical analysis performed by ENEA.** Martelli, A. (ENEA, Bologna (Italy)); Forni, M.; Bonacina, G. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

The first part of the studies in progress in the framework of the Research Co-ordination Meeting (RCM) of IAEA CRP on "Intercomparison of Liquid Metal Fast Breeder Reactor (LMFBR) Seismic Analysis Codes" has been based on the results of dynamic experiments which were performed on various element groups of the PEC fast reactor core. In these tests, individual simplified elements and bundles of seven and nineteen simplified elements reproducing the actual fuel, reflecting and neutron shield elements in full scale were analyzed on shaking tables, in both air and water (simulating liquid sodium). Tests concerned both groups of equal elements and mixed configurations which corresponded to actual core parts. The effects of PEC core-restraint ring were also studied. Seismic excitations to 2.5 g were applied to core diagrid. The results were analyzed by ENEA using both the one-dimensional program CORALIE and the two-dimensional program CLASH. The study allowed the fluid effects in the PEC core to be evaluated; it also contributed to the validation of the above mentioned programs for their general use for fast reactor core analysis. This report describes the experimental and numerical studies and presents comparisons between ENEA calculations and measurements, stressing the most important test features and items which need for particular care in the numerical analyses of experimental data. (author). 24 refs, 19 figs, 10 tabs.

21198 (IAEA-TECDOC–798, pp. 55-78) **Seismic response analysis of the PEC reactor core mock-up.** Morishita, M. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of the Coordinated Research Program on "Intercomparison of LMFBR Seismic Analysis Codes" organized by IAEA/IWGFR, a series of dynamic and seismic response analyses was performed on the PEC reactor core mock-up experiment. The experiment is shaking table tests using up to nineteen full size mock-up elements of PEC reactor. The corresponding analyses were made by FINAS with a five element model (central row) and a twelve element model (upper half core), after some preliminary analyses. The seismic response analyses with the five element and twelve element models give fairly close responses to those measured in the experiment. From these results, it can be concluded that the present analysis is adequate with minor adjustment (damping, for example) may be done. (author). 6 refs, 13 figs, 8 tabs.

21199 (IAEA-TECDOC–798, pp. 79-98) **PEC core mock-up seismic analyses by the finds code.** Itoh, K. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)); Sato, T.; Aizawa, I. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.*

181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

A core seismic analysis code finds for PWR and LMFBR core seismic designs was applied to simulate the Italian fast reactor PEC core seismic experiments. The most excited seismic wave vibration case was chosen for the validation work. The displacements and acceleration responses obtained by analyses and measurements were compared in detail. The close agreements both in displacements and accelerations in time historical domain approved that the finds code is applicable not only to PWR but also to LMFBR core analyses. (author). 3 refs, 18 figs, 8 tabs.

21200 (IAEA-TECDOC–798, pp. 99-107) **Calculation of the PEC test by the SALCON code.** Kobayashi, T. (Toshiba Corp., Yokohama (Japan)). International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

One of the PEC test was calculated by SALCON code to compare the calculation results with the experimental data as well as other analysis codes as a part of the IAEA/IWGFR/CRP on inter comparison of LMFBR seismic analysis codes. At first, features of SALCON code to minimize the computation time are described and then calculation model and condition are explained. As for the calculation result, the calculated displacements generally agreed well with the experimental data. The choice of 4% for the fraction of critical damping was found to be appropriate after evaluating the effect of damping. A reduction of dynamic freedom by Guyan reduction were found to be effective to minimize the computation time while maintaining reasonable accuracy. (author). 4 refs, 3 figs, 4 tabs.

21201 (IAEA-TECDOC–798, pp. 109-120) **Seismic analysis for PEC fast reactor core experiments using the SAFA program.** Horiuchi, T. (Hitachi Ltd., Tokyo (Japan)); Motomiya, T. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

As a part of the IAEA/IWGFR coordinated research program on LMFBR seismic analysis codes, the results of the PEC fast reactor core experiments conducted by Italy were analyzed and the experimental and computational results were compared. The computer program named SAFA developed by Hitachi, Ltd. to analyze core component vibration of fast breeder reactor core components during seismic excitation, was applied for the bench mark calculation. The SAFA models subassemblies as finite element method beam elements. Fluid interaction force is considered as added mass and time integration is done using mode superposition and the method proposed by Nigam. Load paid impact is modeled using a gap, a linear spring, and a linear damper. It also uses a new method to determine the nonlinear impact force without usage of convergence iteration. The comparison of the experimental and calculational results showed a good agreement in displacement and acceleration records. (author). 13 refs, 24 figs, 2 tabs.

21202 (IAEA-TECDOC–798, pp. 121-135) **Stage-II calculations analysis of Italian tests.** Vaze, K.K. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.); Murli, B. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the results of the calculations of seismic behaviour performed for the following Italian tests in water: (a) single fuel element, (b) a cluster of 7 fuel elements, (c) a cluster of 19 fuel elements and (d) a cluster of 9 fuel and 11 reflecting elements. (author). 2 refs, 11 figs, 7 tabs.

21203 (IAEA-TECDOC–798, pp. 137-158) **Analysis of seismic/random tests on fuel and reflector mock-ups (Italian data) by core-seis.** Chellapandi, P. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Ravi, R.; Chetal, S.C.; Bhoje, S.B. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper theoretical analysis of seismic behaviour has been performed on single as well as multiple (seven and nineteen) subassembly core mockups with reference to experimental data supplied by Italy. Analysis is done with the CORE-SEIS code developed at IGCAR, Kalpakkam. (author). 10 figs, 3 tabs.

21204 (IAEA-TECDOC–798, pp. 159-167) **Numerical analysis of the dynamic behaviour of the PEC core by the DINARA code.** Silaev, V.M. (OKB Mechanical Engineering (Russian Federation)). International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

As a part of the CRP on "Seismic Analysis of LMFBR Codes" the participants were made to solve three problems based on the results of dynamic experiments, carried out in water on both single and coupled core simplified mock-up configurations of the Italian PEC fast reactor test facility. Calculation analysis was executed by software-methodical complex (SMC) DINARA which has been developed by NPO TsKTI (Russian Federation). (author). 1 ref., 6 figs, 2 tabs.

21205 (IAEA-TECDOC–798, pp. 169-180) **Seismic behaviour of in air MONJU core mock-up - CEA calculation.** Brochard, D. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)); Gantenbein, F. International Atomic Energy Agency, Vienna (Austria). May 1995. (CONF-9311319–: Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes, Vienna (Austria), 16-17 Nov 1993). In *Intercomparison of liquid metal fast reactor seismic analysis codes. V.1: Validation of seismic analysis codes using reactor core experiments. Proceedings of a research co-ordination meeting held in Vienna, 16-17 November 1993.* 181p. Order Number DE95633614. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents the CASTEM 2000 calculations performed by CEA/DMT in the framework of the IAEA CRP on Intercomparison of LMFR Seismic Analysis Codes. They are related to the seismic behaviour of two types of MONJU core mock-ups: (a) single row layout with 29 assemblies, and (b) hexagonal cluster layout. This study is limited to the analysis of tests performed in air. (author). 7 figs.

21206 (JAERI-Research–95-007) **Experimental study on sodium void reactivity worth in mockup cores of metallic-fueled and MOX-fueled fast reactors using FCA.** Oigawa, Hiroyuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iijima, Susumu. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 101p. (In Japanese). Order Number DE95780485. Source: OSTI; NTIS; INIS.

To improve the calculation accuracy of the sodium void effect in fast reactors, the sodium void reactivity worths were measured at three FCA assemblies: XVI-1, XVI-2 and XVII-1. The former two assemblies simulate metallic-fueled fast reactors and the last one simulates a MOX-fueled fast reactor. Two kinds of measurements, 'step void' and 'void volume dependence', were performed in the central 3x3 drawers of the fixed side of the assemblies. In the former measurement, the axial distribution of local sodium void reactivity worths was obtained to evaluate the calculation accuracy of the non-leakage term and the leakage term separately. In the latter one, various volumes of the sodium void were simulated to evaluate the influence of void volume on the calculation accuracy. The ratios of the calculated reactivity worths to the experimental ones (C/E values) at the core center, which are dominated by the non-leakage term, are 1.08 - 1.20 by JENDL-2 and 0.95 - 1.09 by JENDL-3.1. For the leakage term, on the other hand, the present calculation shows good agreement with the measurements for three assemblies. In addition to above measurements, various extra measurements were performed in assembly XVII-1 for the detailed investigation of the calculation accuracy. The sodium void reactivity worths were measured in various plutonium isotope composition and in the core with a sodium layer which is a design to reduce the sodium void reactivity worth. (author).

21207 (LA-UR--95-1935) **Preconceptual ABC design definition and system configuration layout.** Barthold, W. (Barthold & Associates, Inc., Knoxville, TN (United States)). Los Alamos National Lab., NM (United States). Mar 1995. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014019. Source: OSTI; NTIS; INIS; GPO Dep.

This document is the conceptual design document for the follow-on to the Molten Salt Breeder Reactor, known as the ABC type reactor. It addresses blanket design options, containment options, off-gas systems, drainage systems, and components/layouts of the primary, secondary, and tertiary systems, and it contains a number of diagrams for the configuration of the major systems.

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

Refer also to citation(s) 21237

21208 (JAERI-Research--95-015) **Reactor dynamics experiment of nuclear ship Mutsu using pseudo random signal (III). The third experiment.** Hayashi, Koji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Shimazaki, Junya; Nabeshima, Kunihiko; Ochiai, Masaaki; Shinohara, Yoshikuni; Inoue, Kimihiko. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 178p. (In Japanese). Order Number DE95780587. Source: OSTI; NTIS; INIS.

In order to investigate dynamics of the reactor plant of the nuclear ship Mutsu, the third reactor noise experiment using pseudo random binary sequences (PRBS) was performed on September 16, 1991 in the third experimental navigation. The experiments using both reactivity and load disturbances were performed at 70% of reactor power and under a normal sea condition. Each PRBS was applied by manual operation of the control rod or the main steam valve. Various signals of the plant responses and of the acceleration of ship motion were measured. Furthermore, natural reactor noise signals were measured after each PRBS experiment in order to evaluate the effects of the PRBS disturbances. This paper summarizes the planning of the experiment, the instruction for the experiment and logs, the data recording conditions, recorded signal wave forms and the results of power spectral analysis. (author).

21209 (SAND--95-0903C) **A bimodal power and propulsion system based on cermet fuel and heat pipe energy transport.** Polansky, G.F. (Sandia National Labs., Albuquerque, NM (United States)); Gunther, N.A.; Rochow, R.F.; Bixler, C.H. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950729--4: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95011890. Source: OSTI; NTIS; INIS; GPO Dep.

Bimodal space reactor systems provide both thermal propulsion for the spacecraft orbital transfer and electrical power to the spacecraft bus once it is on station. These systems have the potential to increase both the available payload in high energy orbits and the available power to that payload. These increased mass and power capabilities can be used to either reduce mission cost by permitting the use of smaller launch vehicles or to provide increased mission performance from the current launch vehicle. A major barrier to the deployment of these bimodal systems has been the cost associated with their development. This paper describes a bimodal reactor system with performance potential to permit more than 70% of the instrumented payload of the Titan IV/Centaur to be launched from the Atlas IIAS. The development cost is minimized by basing the design on existing component technologies.

2107 Regulation and Licensing

Refer also to citation(s) 21180, 21181, 21238, 21312, 22370

21210 (NUREG--0040-Vol.19-No.1) **Licensee contractor and vendor inspection status report. Quarterly report, January 1995--March 1995.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Technical Support. May 1995. 110p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This periodical covers the results of inspections performed by the NRC's Special Inspection Branch, Vendor Inspection Section, that have been distributed to the inspected organizations during the period from January 1995 through March 1995.

21211 (NUREG--0540-Vol.17-No.4) **Title list of documents made publicly available, April 1-30, 1995. Volume 17, No. 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jun 1995. 305p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This document is NUREG-0540, Volume 17, Number 4. The Title List of Documents Made Publicly Available is a monthly publication, It contains descriptions of the information received and generated by the US NRC. This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by the NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which the NRC maintains its regulatory records. This series of documents is indexed by a personal author index, a corporate source index, and a report number index.

21212 (NUREG--0750-Vol.41-No.2) **Nuclear Regulatory Commission Issuances: February 1995. Volume 41, Number 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Feb 1995. 114p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This book contains an issuance of the Nuclear Regulatory Commission and a Director's Decision. The issuance concerns consideration by the Commission of appeals from both the Initial Decision and a Reconsideration Order issued by the Presiding Officer involving two materials license amendment applications filed by the University of Missouri. The Director's Decision from the Office of Enforcement denies petitions filed by Northeast Utilities employees requesting that accelerated enforcement action be taken against Northeast Utilities for activities concerned with NU's fitness-for-duty program.

21213 (NUREG--0940-Vol.14-No.1-Pt.3) **Enforcement actions: Significant actions resolved material licensees (non-medical). Volume 14, No. 1, Part 3, Quarterly progress report, January--March 1995.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Enforcement. May 1995. 427p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (January--March 1995) and includes copies of letters, Notices, and Orders sent by

the Nuclear Regulatory Commission to Material Licensees (non-Medical) with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

21214 (NUREG—1430-Vol.2-Rev.1) **Standard technical specifications - Babcock and Wilcox Plants: Bases (Sections 2.0-3.3). Volume 2, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 293p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This NUREG contains the improved Standard Technical Specifications (STS) for Babcock and Wilcox (B&W) plants. Revision 1 incorporates the cumulative changes to Revision 0, which was published in September 1992. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, specifically the B&W Owners Group (BWOG), NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132). Licensees are encouraged to upgrade their technical specifications consistent with those criteria and conforming, to the extent practical and consistent with the licensing basis for the facility, to Revision 1 to the improved STS. The Commission continues to place the highest priority on requests for complete conversions to the improved STS. Licensees adopting portions of the improved STS to existing technical specifications should adopt all related requirements, as applicable, to achieve a high degree of standardization and consistency.

2108 Economics

Refer also to citation(s) 21057

21215 (LA-SUB–95-43) **Estimation of the development possibility of the ABC/ATW fuel cycle based on LiF-BeF_2 fuel salt. Part 2.** Bychkov, A.V. (State Scientific Center of Russian Federation, Dimitrovgrad (Russian Federation). Research Inst. of Atomic Reactors); Naumov, V.S. Los Alamos National Lab., NM (United States); Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation). 1994. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95008967. Source: OSTI; NTIS; INIS; GPO Dep.

The aim of the first chapter was generalization of data on solubility and equilibrium states of fission product and actinide fluorides in fluoride salt melts-solvents and fuel composition melts based on LiF-BeF_2 mixture which was proposed as fuel basis for ABC/ATW facility. The second chapter is devoted to description of processes proposed for the chemical-technological complex of the ABC/ATW facility and their physico-chemical peculiarities. The complex is responsible for the removal of fission products and actinides from irradiated fuel salt.

21216 (ORNL/TM–12925/R1) **Materials considerations for molten salt accelerator-based plutonium conversion systems.** DiStefano, J.R.; DeVan, J.H.; Keiser, J.R.; Klueh, R.L.; Eatherly, W.P. Oak Ridge National Lab., TN (United States). Mar 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012545. Source: OSTI; NTIS; INIS; GPO Dep.

Accelerator-driven transmutation technology (ADTT) refers to a concept for a system that uses a blanket assembly driven by a source of neutrons produced when high-energy protons from an accelerator strike a heavy metal target. One application for such a system is called Accelerator-Based Plutonium Conversion, or ABC. Currently, the version of this concept being proposed by the Los Alamos National Laboratory features a liquid lead target material and a blanket fuel of molten fluorides that contain plutonium. Thus, the materials to be used in such a system must have, in addition to adequate mechanical strength, corrosion resistance to molten lead, corrosion resistance to molten fluoride salts, and resistance to radiation damage. In this report the corrosion properties of liquid lead and the LiF-BeF_2 molten salt system are reviewed in the context of candidate materials for the above application. Background information has been drawn from extensive past studies. The system operating temperature, type of protective environment, and oxidation potential of the salt are shown to be critical design considerations. Factors such as the generation of fission products and transmutation of salt components also significantly affect corrosion behavior, and procedures for inhibiting their effects are discussed. In view of the potential for extreme conditions relative to neutron fluxes and energies that can occur in an ADTT, a knowledge of radiation effects is a most important factor. Present information for potential materials selections is summarized.

21217 (SAKL-JULK–A209) **The effects of the Olkiluoto nuclear power plant on the infrastructure and the economy of the region.** Aelli, E. Satakuntaliitto, Pori (Finland). 1993. 89p. (In Finnish). Order Number DE95632481. Source: OSTI; NTIS; INIS.

The study investigates the effects of the nuclear power plant (TVO I and TVO II), situated on the island of Olkiluoto in Eurajoki municipality and owned by Industrial Power Company Ltd. (TVO), on the infrastructure and economy of the region. The report aims primarily at investigating the effects of the power units during the period they have been in function on Eurajoki municipality and Satakunta province, while it also deals with other, significant separate investments on Olkiluoto. in addition, the survey looks at the effects of a prospective third power unit (TVO III) on local economy as well as the effects of a final storage facility for spent fuel, possibly to be built in the area. (author) (94 refs., 28 figs., 3 tabs).

21218 (SR/OIAF–95-01) **An analysis of nuclear power plant operating costs: A 1995 update.** USDOE Energy Information Administration, Washington, DC (United States). Office of Integrated Analysis and Forecasting. 21 Apr 1995. 82p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011130. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

Over the years real (inflation-adjusted) O&M cost have begun to level off. The objective of this report is to determine whether the industry and NRC initiatives to control costs have resulted in this moderation in the growth of O&M costs. Because the industry agrees that the control of O&M costs is crucial to the viability of the technology, an examination of the factors causing the moderation in costs is important. A related issue deals with projecting nuclear operating costs into the future. Because of the escalation in nuclear operating costs (and the fall in fossil fuel prices) many State and Federal regulatory commissions are examining the economics of the continued operation of nuclear power plants under their jurisdiction. The economics of the continued operation of a nuclear power plant is typically examined by comparing the cost of the plants continued operation with the cost of obtaining the power from other sources. This assessment requires plant-specific projections of nuclear operating costs. Analysts preparing these projections look at past industry-wide cost trends and consider whether these trends are likely to continue. To determine whether these changes in trends will continue into the future, information about the causal factors influencing costs and the future trends in these factors are needed. An analysis of the factors explaining the moderation in cost growth will also yield important insights into the question of whether these trends will continue.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory and Calculation

Refer also to citation(s) 21193, 21316, 21730, 21737, 21738, 21739, 21741, 21744, 21748, 21749, 22934

21219 (ANL/RA/CP–85371) **Heterogeneous treatment in the variational nodal method.** Fanning, T.H. (Wisconsin Univ.,

Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics); Palmiotti, G. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950420–26: International conference on mathematics and computations, reactor physics, and environmental analyses, Portland, OR (United States), 30 Apr - 4 may 1995). Order Number DE95012282. Source: OSTI; NTIS; INIS; GPO Dep.

The variational nodal transport method is reduced to its diffusion form and generalized for the treatment of heterogeneous nodes while maintaining nodal balances. Adapting variational methods to heterogeneous nodes requires the ability to integrate over a node with discontinuous cross sections. In this work, integrals are evaluated using composite gaussian quadrature rules, which permit accurate integration while minimizing computing time. Allowing structure within a nodal solution scheme avoids some of the necessity of cross section homogenization, and more accurately defines the intra-nodal flux shape. Ideally, any desired heterogeneity can be constructed within the node; but in reality, the finite set of basis functions limits the practical resolution to which fine detail can be defined within the node. Preliminary comparison tests show that the heterogeneous variational nodal method provides satisfactory results even if some improvements are needed for very difficult, configurations.

21220 (FEI–2355) **Measurement of β_{eff} and neutron lifetime in fast critical assemblies for transition from BNAB-78 constant system to BNAB-90 one.** Tarasova, O.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 16p. (In Russian). Order Number DE95633538. Source: OSTI; NTIS (US Sales Only); INIS.

The difference between the values of effective delayed neutron fraction and of prompt neutron life-time calculated with MCDEN code using constant systems BNAB-78 and BNAB-90 is estimated for a large number of fast critical assemblies' models. The comparison with experimental results is given. It's shown that the using of BNAB-90 eliminates the neutron life-time underestimation that had place with the constant system BNAB-78. 14 refs.; 1 fig.; 6 tabs.

21221 (LA–12556-C, pp. 84-91) **Experimental and computational benchmark tests.** Gilliam, D.M.; Briesmeister, J.F. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

A program involving principally NIST, LANL, and ORNL has been in progress for about four years now to establish a series of benchmark measurements and calculations related to the moderation and leakage of ^{252}Cf neutrons from a source surrounded by spherical aqueous moderators of various thicknesses and compositions. The motivation for these studies comes from problems in criticality calculations concerning arrays of multiplying components, where the leakage from one component acts as a source for the other components. This talk compares experimental and calculated values for the fission rates of four nuclides - ^{235}U, ^{239}Pu, ^{238}U, and ^{237}Np - in the leakage spectrum from moderator spheres of diameters 76.2 mm, 101.6 mm, and 127.0 mm, with either pure water or enriched B-10 solutions as the moderator. Very detailed Monte Carlo calculations were done with the MCNP code, using a "light water" S(α,β) scattering kernel.

21222 (LA–12556-C, pp. 92-94) **Operating experience at a University-based reactor critical facility.** Harris, D.R.; Conner, K.J.; Rohr, R.C.; Bucher, S.W. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

Reactor critical experiments are carried out in order to validate, improve, and calibrate the extensive calculations required for licensed operation of new and reload power reactors. Many such experiments have been carried out, and new ones are required only when: (a) sufficiently new situations arise, for example, increased enrichment and new fuel types for light water (LWR) power reactors; (b) the measurements are sufficiently accurate; and (c) the measurements are sufficiently cost-effective. The Rensselaer Polytechnic Institute's Reactor Critical Facility (RCF) has an annual budget of only about $50,000 per year, and state-of-the-art critical experiments have been carried out for several years for certain relatively new situations. The low cost (at least an order of magnitude less than typical) is due to the use of students and faculty in a combined research and training mode of operation. Here the facility, its capabilities, its operation, and current research are described.

2202 Components and Accessories

Refer also to citation(s) 21183, 21266, 21299, 21318, 21565, 21823, 22072, 22919

21223 (ANL/IFR/CP–84089) **Applying neural networks to optimize instrumentation performance.** Start, S.E.; Peters, G.G. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950564–8: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95009466. Source: OSTI; NTIS; INIS; GPO Dep.

Well calibrated instrumentation is essential in providing meaningful information about the status of a plant. Signals from plant instrumentation frequently have inherent non-linearities, may be affected by environmental conditions and can therefore cause calibration difficulties for the people who maintain them. Two neural network approaches are described in this paper for improving the accuracy of a non-linear, temperature sensitive level probe ised in Expermental Breeder Reactor II (EBR-II) that was difficult to calibrate.

21224 (CONF-950740–42) **An interim report on shallow-flaw fracture technology development.** Pennell, W.E.; Bass, B.R.; Bryson, J.W.; McAfee, W.J. Oak Ridge National Lab., TN (United States). [1995]. 13p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995. Source: OSTI; NTIS; INIS.

Shallow-flaw fracture technology is being developed for application to the safety assessment of radiation-embrittled nuclear reactor pressure vessels (RPVS) containing flaws. Fracture mechanics tests on RPV steel, coupled with detailed elastic-plastic finite-element analyses of the crack-tip stress fields, have shown that (1) constraint relaxation at the crack tip of shallow surface flaws results in increased data scatter but no increase in the lower-bound fracture toughness, (2) the nil ductility temperature (NDT) performs better than the reference temperature for nil ductility transition (RT_{NDT}) as a normalizing parameter for shallow-flaw fracture toughness data, (3) biaxial loading can reduce the shallow-flaw fracture toughness, (4) stress-based dual-parameter fracture toughness correlations cannot predict the effect of biaxial loading on shallow-flaw fracture toughness because in-plane stresses at the crack tip are not influenced by biaxial loading, and (5) a strain-based dual-parameter fracture toughness correlation can predict the effect of biaxial loading on shallow-flaw fracture toughness.

21225 (CONF-950740–47) **Fracture analysis of the NESC-1 spinning cylinder experiment.** Keeney, J.A.; Bass, B.R. Oak Ridge National Lab., TN (United States). [1995]. 6p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Interagency Agreement 1886-8570-3B. From Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995. Order Number DE95013203. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents finite-element analyses of the cylinder specimen being used in the international Network for Evaluating Steel Components (NESC) large-scale spinning-cylinder project (NESC-1). The objective of the NESC-1 project is to focus on a complete process for assessing the structural integrity of aged reactor pressure vessels. A new cylinder specimen was reconstituted from

segments of the previously tested SC-4 and SC-6 specimens because the relatively high fracture toughness of the original specimen might preclude achieving the test objectives. Also, the initial and coolant temperatures for the proposed thermal shock may be reduced as much as 25 C to increase the probability of achieving cleavage initiation. Analyses were carried out to determine the combined effects of increasing the wall thickness and lowering the initial and coolant temperatures in the experiment. Estimates were made of the change in hoop strain on the clad inner surface directly above a subclad crack due to initiation and axial propagation of the crack. Three-dimensional finite-element models of the cladded cylinder were generated with 6:1 and 2:1 semielliptical 70-mm-deep subclad cracks. The cylinder specimen was subjected to thermal-shock and centrifugal loading conditions and analyzed with a thermo-elastic-plastic material model. The analytical results indicate that lowering the initial and coolant temperatures by 25 C will not significantly change the peak driving force, but will shift the stress-intensity factor (K_I) vs temperature curves so that the crack will become critical at an earlier time in the transient. The peak K_I value occurs at a lower temperature which increases the probability of achieving cleavage initiation.

21226 (CONF-950804–3) **Thermal embrittlement of reactor vessel steels.** Corwin, W.R. (Oak Ridge National Lab., TN (United States)); Nanstad, R.K.; Alexander, D.J.; Stoller, R.E.; Wang, J.A.; Odette, G.R. Oak Ridge National Lab., TN (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. A doe 1886-8109-8l. From 13. international conference on structural mechanics in reactor technology; Porto Alegre (Brazil); 13-18 Aug 1995. Order Number DE95012298. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of observations of possible thermal embrittlement from recent studies with welds removed from retired steam generators of the Palisades Nuclear Plant (PNP), an assessment was made of thermal aging of reactor pressure vessel (RPV) steels under nominal reactor operating conditions. Discussions are presented on (1) data from the literature regarding relatively low-temperature thermal embrittlement of RPV steels; (2)relevant data from the US power reactor-embrittlement data base (PR-EDB); and (3)potential mechanisms of thermal embrittlement in low-alloy steels.

21227 (INIS-GB–660) **Statement of nuclear incidents at nuclear installations: fourth quarter 1994.** Health and Safety Executive, London (United Kingdom). 3 Apr 1995. 7p. Order Number DE95632434. Source: OSTI; NTIS (US Sales Only); INIS.

Four nuclear incidents at installations in the United Kingdom during the fourth quarter of 1994 are reported. Reheat cracking occurred at four non-stressed-relieved welds in steam pipework at one of the two AGRs at the Dungeness B power station. Repairs have been carried out and an extensive inspection programme undertaken for welds most at risk on both reactors. The event was classified as Level O on the International Nuclear Event Scale. A small quantity of oil with a very low level of radioactive contamination was discharged into the air from the Hartlepool nuclear power station. Contamination was confined to land belonging to the utility, Nuclear Electric. The oil was traced to the vacuum services plant and measures necessary to prevent a further incident are being established. The Nuclear Installations Inspectorate was satisfied that there was no disregard of safety and the event has been classified as Level 1. A higher than normal level of CO_2, 2%, was discovered in a stairwell in a reactor building at the Dungeness B AGR station. No radioactivity was detected, the source of the leak was found and the event classified as Level O. Appropriate actions have been taken to prevent a recurrence. The final incident arose at the British Nuclear Fuels Sellafield Site. A bursting disk on an inactive compressor cooling circuit burst releasing ten cubic metres of clean water into the building operating area. The water became contaminated by 10^9 to 10^{10} Bq of beta/gamma radioactivity under a lead shielded area of floor and as a consequence of a drain blockage overflowed onto a site road. Decontamination of about 4 m^2 of road was required. No personnel were affected by radioactivity and the incident was classified as Level 1. (UK).

21228 (JAERI-Tech–95-012) **Program development of the feature extraction from an intensity image for identifying the location of the mobile robot.** Ebihara, Ken-ichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 58p. (In Japanese). Order Number DE95780604. Source: OSTI; NTIS; INIS.

An intelligent robot, which autonomously patrols and inspects nuclear facilities instead of a human worker, needs to know its own position and orientation in the workspace. Generally, a mobile robot obtains its current position and orientation using the dead reckoning scheme in which the distance and orientation are measured by an odometer and gyrocompass. During the longtime movement of the robot, however, the accuracy of the location information gradually decreases because of accumulating error which is caused by some uncertain factors, such as slippage wheels and floor, and cannot be exactly estimated. Therefore it is necessary and important for the mobile robot to be able to correct the current location obtained by the dead reckoning scheme at anywhere in the workspace. There are some methods to correct the location information, such as infrared beacon system, detecting a mark which is put in the environment. It may be the most desirable method to estimate the position and orientation using some features extracted from and image of environmental objects taken by a CCD camera mounted on the robot. This report describes the development of the program which extracts some features from an intensity image of equipments in the nuclear facility. The output data from the program will be used to identify the location of the mobile robot in the workspace. The overview of sensing system which includes a CCD camera to take necessary images and the characteristics of the CCD camera are also reported. (author).

21229 (NUREG/CR–5591-Vol.3) **Heavy-Section Steel Irradiation Program: Volume 3, Progress report, October 1991–September 1992.** Corwin, W.R. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering Technology; Oak Ridge National Lab., TN (United States). Feb 1995. 45p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (ORNL/TM–11568-Vol.3). Source: OSTI; NTIS; INIS.

The primary goal of the Heavy-Section Steel Irradiation Program is to provide a thorough, quantitative assessment of the effects of neutron irradiation on the material behavior, and in particular the fracture toughness properties, of typical pressure vessel steels as they relate to light-water reactor pressure-vessel integrity. Effects of specimen size, material chemistry, product form and microstructure, irradiation fluence, flux, temperature and spectrum, and postirradiation annealing are being examined on a wide range of fracture properties. The HSSI Program is arranged into 10 tasks: (1) program management, (2) K_{Ic} curve shift in high-copper welds, (3) K_{Ia} curve shift in high-copper welds, (4) irradiation effects on cladding, (5) K_{Ic} and K_{Ia} curve shifts in low upper-shelf welds, (6) irradiation effects in a commercial low upper-shelf weld, (7) microstructural analysis of irradiation effects, (8) in-service aged material evaluations, (9) correlation monitor materials, and (10) special technical assistance. This report provides an overview of the activities within each of these tasks from October 1991 to September 1992.

21230 (NUREG/CR–5944-Vol.1) **A characterization of check valve degradation and failure experience in the nuclear power industry: 1984-1990. Volume 1.** Casada, D.A. (Oak Ridge National Lab., TN (United States)); Todd, M.D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Oak Ridge National Lab., TN (United States). Sep 1993. 175p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL–6734-Vol.1). Source: OSTI; NTIS; INIS.

Check valve operating problems in recent years have resulted in significant operating transients, increased cost and decreased system availability. As a result, additional attention has beau given to check valves by utilities (resulting in the formation of the Nuclear Industry Check Valve Group), as well as the US Nuclear Regulatory Commission and the American Society of Mechanical Engineers Operation and Maintenance Committee. All these organizations have the fundamental goal of ensuring reliable operation of check valves. A key ingredient to an engineering-oriented reliability improvement effort is a thorough understanding of relevant

historical experience. A detailed review of historical failure data, available through the Institute of Nuclear Power Operation's Nuclear Plant Reliability Data System, has been conducted. The focus of the review is on check valve failures that have involved significant degradation of the valve internal parts. A variety of parameters are considered, including size, age, system of service, method of failure discovery, the affected valve parts, attributed causes, and corrective actions.

2203 Fuel Elements

Refer also to citation(s) 21297, 21583

21231 (STUK/YVL-GUIDE–6.3) **Regulatory control of fuel design and manufacturing.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1994. 12p. Order Number DE95631351. Source: OSTI; NTIS; INIS.

Translation. The original text in Finnish is published under the same guide number. The guide is valid from 1 November 1993 and will remain in force until further notice. It replaces the guide YVL 6.3 issued on 15 February 1983.

The regulatory control of the design and manufacturing of the nuclear fuel and of the control rods aims to ensure conformance to set requirements during normal operating conditions, anticipated operational transients and postulated accident conditions. The regulatory control of design, manufacturing, receiving inspections and the start of operation of the nuclear fuel are specified in the guide. The regulatory control procedure also applies to the control rods and the shield elements.

21232 (STUK/YVL-GUIDE–6.7) **Quality assurance of nuclear fuel.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1994. 11p. Order Number DE95631352. Source: OSTI; NTIS; INIS.

Translation. The original text in Finnish is published under the same guide number. The guide is valid from 1 January 1994 and will remain in force until further notice. The guide replaces the guide YVL 6.7 issued on 11 October 1993.

The guide presents the quality assurance requirements to be completed with in the procurement, design, manufacture, transport, handling and operation of the nuclear fuel. The guide also applies to the procurement of the control rods and the shield elements to be placed in the reactor. The guide is mainly aimed for the licensee responsible for the procurement and operation of fuel, for the fuel designer and manufacturer and for other organizations whose activities affect fuel quality, the safety of fuel transport, storage and operation. (2 refs.).

2204 Control Systems

Refer also to citation(s) 21294, 21307, 21313

21233 (ANL/ED/CP–85853) **Failed fuel monitoring and surveillance techniques for liquid metal cooled fast reactors.** Lambert, J.D.B. (Argonne National Lab., IL (United States)); Mikaili, R.; Gross, K.C.; Strain, R.V.; Aoyama, T.; Ukai, S.; Nomura, S.; Nakae, N. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950311–3: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95011954. Source: OSTI; NTIS; INIS; GPO Dep.

The Experimental Breeder Reactor II (EBR-II) has been used as a facility for irradiation of LMR fuels and components for thirty years. During this time many tests of experimental fuel were continued to cladding breach in order to study modes of element failure; the methods used to identify such failures are described in a parallel paper. This paper summarizes experience of monitoring the delayed-neutron (DN) and fission-gas (FG) release behavior of a smaller number of elements that continued operation in the run-beyond-cladding-breach (RBCB) mode. The scope of RBCB testing, the methods developed to characterize failures on-line, and examples of DN/FG behavior are described.

21234 (ANL/RA/CP–84091) **COREMAP: Graphical user interface for displaying reactor core data in an interactive hexagon map.** Muscat, F.L.; Derstine, K.L. Argonne National Lab., IL (United States). [1995]. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950420–Handbk: International conference on mathematics and computations, reactor physics, and environmental analyses, Portland, OR (United States), 30 Apr - 4 may 1995). Order Number DE95012923. Source: OSTI; NTIS; INIS; GPO Dep.

COREMAP is a Graphical User Interface (GUI) designed to assist users read and check reactor core data from multidimensional neutronic simulation models in color and/or as text in an interactive 2D planar grid of hexagonal subassemblies. COREMAP is a complete GEODST/RUNDESC viewing tool which enables the user to access multi data set files (e.g. planes, moments, energy groups ,...) and display up to two data sets simultaneously, one as color and the other as text. The user (1) controls color scale characteristics such as type (linear or logarithmic) and range limits, (2) controls the text display based upon conditional statements on data spelling, and value. (3) chooses zoom features such as core map size, number of rings and surrounding subassemblies, and (4) specifies the data selection for supplied popup subwindows which display a selection of data currently off-screen for a selected cell, as a list of data and/or as a graph. COREMAP includes a RUNDESC file editing tool which creates "proposed" Run-description files by point and click revisions to subassembly assignments in an existing EBRII Run-description file. COREMAP includes a fully automated printing option which creates high quality PostScript color or greyscale images of the core map independent of the monitor used, e.g. color prints can be generated with a session from a color or monochrome monitor. The automated PostScript output is an alternative to the xgrabsc based printing option. COREMAP includes a plotting option which creates graphs related to a selected cell. The user specifies the X and Y coordinates types (planes, moment, group, flux ,...) and a parameter, P, when displaying several curves for the specified (X, Y) pair COREMAP supports hexagonal geometry reactor core configurations specified by: the GEODST file and binary Standard Interface Files and the RUNDESC ordering.

21235 (ANL/RA/CP–84204) **A pattern-recognition-based, fault-tolerant monitoring and diagnostic technique.** Singer, R.M. (and others); Gross, K.C.; King, R.W. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9506121–2: 7. international symposium on nuclear reactor surveillance and diagnostics, Avignon (France), 19-23 Jun 1995). Order Number DE95013518. Source: OSTI; NTIS; GPO Dep.

A properly designed monitoring and diagnostic system must be capable of detecting and distinguishing sensor and process malfunctions in the presence of signal noise, varying process states and multiple faults. The technique presented in this paper addresses these objectives through the implementation of a multivariate state estimation algorithm based upon pattern recognition methodology coupled with a statistically-based hypothesis test. Utilizing a residual signal vector generated from the difference between the estimated and measured current states of a process, disturbances are detected and identified with statistical hypothesis testing. Since the hypothesis testing utilizes the inherent noise on the signals to obtain a conclusion and the state estimation algorithm requires only a majority of the sensors to be functioning to ascertain the current state, this technique has proven to be quite robust and fault-tolerant. Several examples of its application are presented.

21236 (CONF-950397–1) **Design and testing of integrated circuits for reactor protection channels.** Battle, R.E. (Oak Ridge National Lab., TN (United States)); Vandermolen, R.I.; Jagadish, U.; Swail, B.K.; Naser, J.; Rana, I. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC05-84OR21400. From Joint DOE/EPRI international conference on cost-effective instrumentation and control technology upgrades for nuclear power plants; Nashville, TN (United States); 22-24 Mar 1995. Order Number DE95012868. Source: OSTI; INIS; NTIS; GPO Dep.

Custom and semicustom application-specific integrated circuit design and testing methods are investigated for use in research

and commercial nuclear reactor safety systems. The Electric Power Research Institute and Oak Ridge National Laboratory are working together through a cooperative research and development agreement to apply modern technology to a nuclear reactor protection system. Purpose of this project is to demonstrate to the nuclear industry an alternative approach for new or upgrade reactor protection and safety system signal processing and voting logic. Motivation for this project stems from (1) the difficulty of proving that software-based protection systems are adequately reliable, (2) the obsolescence of the original equipment, and (3) the improved performance of digital processing.

21237 (LA-SUB–95-45) **Data processing unit and power system for the LANL REM instrument package. Final report.** Lockhart, W. (Southwest Research Inst., San Antonio, TX (United States). Instrumentation and Space Research Div.). Los Alamos National Lab., NM (United States); Southwest Research Inst., San Antonio, TX (United States). Instrumentation and Space Research Div. Mar 1994. 81p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011854. Source: OSTI; NTIS; GPO Dep.

The NEPSTP spacecraft needs highly reliable instrumentation to measure the nuclear reactor health and performance. These reactor measurements are essential for initial on-orbit phase operations and documentation of performance over time. Los Alamos National Laboratory (LANL), under the guidance of W. C. Feldman, principal investigator, has designed the Radiation Environment Monitoring (REM) package to meet these needs. The instrumentation package contains two neutron detectors, one gamma-ray detector, a data processing unit, and an instrument power system. The REM package is an integration of quick turn-around, state of the practice technology for detectors, data processors, and power systems. A significant portion of REM consists of subsystems with flight history. Southwest Research Institute (SwRI) has been tasked by LANL to design support electronics, including the Data Processing Unit (DPU) and Power System for REM. The goal for this project is to use technologies from current programs to speed up and simplify the design process. To meet these design goals, the authors use an open architecture VME bus for the DPU and derivatives of CASSINI power supplies for the instrument power system. To simplify integration and test activities, they incorporate a proven software development strategy and tool kits from outside vendors. The objective of this report is to illustrate easily incorporated system level designs for the DPU, power system and ground support electronics (GSE) in support of the important NEPSTP program.

21238 (NUREG–1433-Vol.2-Rev.1) **Standard Technical Specifications General Electric plants, BWR/4: Bases (Sections 2.0-3.3). Volume 2, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Project Support. Apr 1995. 337p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry produce improved Standard Technical Specifications (STS), Revision 1 for General Electric BWR/4 Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved ST or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume I contains the Specifications for all chapters and sections of the improved STS. This document, Volume 2, contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1-3.3 of the improved STS. Volume 3 contains the Bases for Sections 3.4-3.10 of the improved STS.

21239 (NUREG/CR–6312) **Assessment of fiber optic pressure sensors.** Hashemian, H.M. (Analysis and Measurement Services Corp., Knoxville, TN (United States)); Black, C.L.; Farmer, J.P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Analysis and Measurement Services Corp., Knoxville, TN (United States). Apr 1995. 130p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report presents the results of a six-month Phase 1 study to establish the state-of-the-art in fiber optic pressure sensing and describes the design and principle of operation of various fiber optic pressure sensors. This study involved a literature review, contact with experts in the field, an industrial survey, a site visit to a fiber optic sensor manufacturer, and laboratory testing of a fiber optic pressure sensor. The laboratory work involved both static and dynamic performance tests. In addition, current requirements for environmental and seismic qualification of sensors for nuclear power plants were reviewed to determine the extent of the qualification tests that fiber optic pressure sensors may have to meet before they can be used in nuclear power plants. This project has concluded that fiber optic pressure sensors are still in the research and development stage and only a few manufacturers exist in the US and abroad which supply suitable fiber optic pressure sensors for industrial applications. Presently, fiber optic pressure sensors are mostly used in special applications for which conventional sensors are not able to meet the requirements.

2205 Environmental Aspects

Refer also to citation(s) 20787, 21192, 21301, 21302, 21304, 22168, 22404, 22405, 22406

21240 (IAEA-TECDOC–795) **Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).** International Atomic Energy Agency, Vienna (Austria). Apr 1995. 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The VAMP Multiple Pathways Assessment Working Group is an international forum for the testing and comparison of model predictions. The emphasis is on evaluating transfer from the environment to human via all pathways which are relevant in the environment being considered. This document is the first report of the Group and contains the results of the first test exercise on the validation of multiple pathways assessment models using Chernobyl fallout data obtained from the Central Bohemia (CB) region of the Czech Republic (Scenario CB). The report includes the following three appendixes: Documentation and evaluation of model validation data used in scenario CB (3 papers), Description of models used in scenario CB (1 paper), Individual evaluations of model predictions for scenario CB (13 papers). A separate abstract was prepared for each paper. Refs, figs and tabs.

21241 (IAEA-TECDOC–795, pp. 43-52) **Description of test scenario CB.** Kliment, V.; Bucina, I.; Malatova, I. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The report contains general information on the test region CB (Central Bohemia), data on radionuclide concentrations in ground-level air and on soil contamination, agricultural and demographic information, input information available on diskette and assessment tasks for model testing (total deposition, ^{137}Cs concentrations in food products, human intake, concentrations in animal feeds, whole body content, multiple pathways dose assessment). Refs, figs and tabs.

21242 (IAEA-TECDOC–795, pp. 53-63) **Measured data on Cs-137 contamination of CB environment.** Malatova, I.; Bucina, I.; Drabova, D. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data*

from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP). 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

A general description of procedures used for measuring the environmental ^{137}Cs contamination in Central Bohemia following the Chernobyl accident, the data sets available with their statistical characteristics and the additional measurements performed for aerosol particle size distribution, soil contamination and internal contamination of people are presented. Refs, figs and tabs.

21243 (IAEA-TECDOC–795, pp. 113-170) **Description of models used in scenario CB.** Galeriu, D.; Kanyar, B.; Kliment, V.; Hinton, T.; Peterson, S.R. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

Within the working group for the CB Scenario, comparison of predictions with observations revealed which models had the most accurate predictions. Subsequently, explanations for success or failure were obtained through comparison of model structure, assumptions, and parameter values. Here are given descriptions for all participating models of the assumptions, equations, and parameter values used to calculate the initial predictions which were "frozen" for model intercomparison. 4 refs, 17 figs, 7 tabs.

21244 (IAEA-TECDOC–795, pp. 173-182) **Application of DOSDIM model to CB scenario.** Zeevaert, T. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Sohir, A.; Lewyckyj, N. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The DOSDIM (DOse Distribution Model) model is a compartmental, deterministic, radiological impact assessment model for both routine and accidental atmospheric releases. For an accidental release, dynamic transfers are used in apposition to a routine release for which equilibrium transfer factors are used. The model itself was constructed to predict best-estimates but parameter values were chosen to be conservative. Transfers between compartments are described by first-order differential equations. 3 refs, 8 figs.

21245 (IAEA-TECDOC–795, pp. 183-196) **Evaluation of CHERPAC performance for CB scenario.** Peterson, S.R. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The CHERPAC (Chalk River Environmental Research Pathways Analysis Code) model is a time-dependent model that uses inputs of daily air concentrations to calculate average monthly concentrations in the different food chain compartments contributing to ingestion dose. Dose from inhalation and external irradiation from the plume and surfaces are also calculated. 10 figs, 1 tab.

21246 (IAEA-TECDOC–795, pp. 205-212) **Application of SCHRAADLO-T performance for CB scenario.** Horyna, J. (State Office for Nuclear Safety, Prague (Czech Republic)). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The model SCHRAADLO was developed to assess the environmental impact of nuclear facilities. It is a time dependent compartmental model driven by daily air concentration and daily precipitation rate. The output are time dependent concentrations in soil, different types of meat and plants, milk and whole body. The model SCHRAADLO-T is a modification of the above model where some parameters have been modified according to the Chernobyl experiences. The model can be used for accidental as well as for routine releases. 2 figs, 2 tabs.

21247 (IAEA-TECDOC–795, pp. 223-226) **TERNIRBU - Evaluation of model performance for scenario CB.** Kanyar, B. (National Research Inst. for Radiobiology and Radiohygiene, Budapest (Hungary)); Fueloep, N. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

TERNIRBU (TERrestrial model for the National Research Institute of Radiobiology and Radiohygiene, BUdapest) model consists of systems of ordinary differential equations with linear and nonlinear terms. It contains 77 parameters which can be changed at any time depending on the scenario evaluations. Therefore it can take account of any countermeasures implemented during the period of interest and other irregular changes. It can be used for predicting the radiological consequences of accidental releases of radionuclides. 3 refs, 2 figs.

21248 (IAEA-TECDOC–795, pp. 227-240) **ECOSYS-G - Individual evaluation of model performance for CB scenario.** Mueller, H. (GSF - Inst. fuer Strahlenschultz, Neuherberg (Germany)); Proehl, G. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

The time-dependent radioecological simulation model ECOSYS has been developed in order to assess the radiological consequences of short-term depositions of radionuclides. Internal exposure via inhalation and ingestion as well as the external exposure from the passing cloud and from radioactivity deposited on the ground are included. The ingestion dose is calculated as a function of time considering 18 plant species, 11 animal food products and 18 processed products. 9 figs.

21249 (IAEA-TECDOC–795, pp. 241-252) **Individual evaluation of model performance for scenario CB.** Krajewski, P. (Central Lab. for Radiological Protection, Warsaw (Poland)); Pietrzak-Flis, Z. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

CLRP (Concentration Levels Rapid Predictions) model was developed to examine the fate of long-lived radionuclides in the terrestrial ecosystem. Dynamic processes in the model include foliar interception, weathering, plant growth and root uptake, leaching and radioactive decay. The model considers seasonal changes in the biomass of vegetation and animal diets, specific plowing and crop-harvest dates. Human dietary data are included to permit calculation of time-dependent radionuclide ingestion rates for adult, youngster 10 years old and child 1 year old. All dynamic processes are described by exponential formulas and are solved numerically. 4 figs, 5 tabs.

21250 (IAEA-TECDOC–795, pp. 253-263) **Evaluation of LINDOZ performance for CB scenario.** Galeriu, D. (Institute of Atomic Physics, Bucharest (Romania)); Apostoaie, I.; Mocanu, N.; Paunescu, N. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

LINDOZ model has been developed to provide the concentration of pollutants in terrestrial ecosystem (soil, vegetation, animal tissues and animal products), concentration in whole body of humans due to inhalation and ingestion, external irradiation from cloud and soil. The model is structured at process level with compartments oriented to describe transfer processes and to include the influence of physico-chemical properties of pollutants or local characteristics. As a unique feature, the model include explicitly the initial solubility of fallout particles and gases. 6 figs, 4 tabs.

21251 (IAEA-TECDOC–795, pp. 264-272) **Evaluation of PRYMA model's performance for CB scenario.** Garcia Olivares, A.J. (CIEMAT - Environmental Research Inst., Madrid (Spain)); Carrasco, E.; Suanez, A.; Font, J.L.; Cancio, D. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

PRYMA model was developed for pathways air-food, air-pasture, air-feed (except pasture). It uses ordinary first-order differential equations for all the transfers except the root uptake where daily equilibrium is assumed. 6 figs.

21252 (IAEA-TECDOC–795, pp. 273-283) **ECOSYS-CH - Evaluation of model performance for scenario CB.** Hinton, T.G. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

ECOSYS-CH predicts the dynamics of radionuclide concentrations in grains using time-dependent leaf area indices that determine the initial plant contamination, and time-dependent translocation factors that govern the transfer of contamination from leaves to the edible portions of plants. It also accounts for the reduction of radionuclide concentrations in pasture due to plant growth by using the yield at the time of deposition and a monthly dependent loss rate, representing growth dilution. 4 figs, 5 tabs.

21253 (IAEA-TECDOC–795, pp. 284-286) **GENII - Comparison of model predictions with observations.** Napier, B.A. (Battelle Pacific Northwest Lab., Richland, WA (United States)). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

GENII is a simplified, steady state, multiplicative chain model which gives an upper bound on potential doses resulting from hypothetical acute releases.

21254 (LA-SUB–95-21) **A three-dimensional transient neutronics routine for the TRAC-PF1 reactor thermal hydraulic computer code.** Bandini, B.R. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States); Pennsylvania State Univ., University Park, PA (United States). Dept. of Nuclear Engineering. May 1990. 290p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95007620. Source: OSTI; NTIS; INIS; GPO Dep.

No present light water reactor accident analysis code employs both high state of the art neutronics and thermal-hydraulics computational algorithms. Adding a modern three-dimensional neutron kinetics model to the present TRAC-PF1/MOD2 code would create a fully up to date pressurized water reactor accident evaluation code. After reviewing several options, it was decided that the Nodal Expansion Method would best provide the basis for this multidimensional transient neutronic analysis capability. Steady-state and transient versions of the Nodal Expansion Method were coded in both three-dimensional Cartesian and cylindrical geometries. In stand-alone form this method of solving the few group neutron diffusion equations was shown to yield efficient and accurate results for a variety of steady-state and transient benchmark problems. The Nodal Expansion Method was then incorporated into TRAC-PF1/MOD2. The combined NEM/TRAC code results agreed well with the EPRI-ARROTTA core-only transient analysis code when modelling a severe PWR control rod ejection accident.

21255 (LA-UR–95-926) **Analysis of an AP600 intermediate-size loss-of-coolant accident.** Boyack, B.E.; Lime, J.F. Los Alamos National Lab., NM (United States). [1995]. 14p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950904–3: 7. international meeting on nuclear reactor thermal hydraulics, Saratoga, NY (United States), 10-15 Sep 1995). Source: OSTI; NTIS; INIS.

A postulated double-ended guillotine break of an AP600 direct-vessel-injection line has been analyzed. This event is characterized as an intermediate-break loss-of-coolant accident. Most of the insights regarding the response of the AP600 safety systems to the postulated accident are derived from calculations performed with the TRAC-PF1/MOD2 code. However, complementary insights derived from a scaled experiment conducted in the ROSA facility, as well as insights based upon calculations by other codes, are also presented. Based upon the calculated and experimental results, the AP600 will not experience a core heat up and will reach a safe shutdown state using only safety-class equipment. Only the early part of the long-term cooling period initiated by In-containment Refueling Water Storage Tank injection was evaluated. Thus, the observation that the core is continuously cooled should be verified for the later phase of the long-term cooling period when sump injection and containment cooling processes are important.

21256 (NUREG/CR–6318) **Data summary report for fission product release Test VI-7.** Osborne, M.F. (Oak Ridge National Lab., TN (United States)); Lorentz, R.A.; Travis, J.R.; Collins, J.L.; Webster, C.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Oak Ridge National Lab., TN (United States). May 1995. 53p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–12937). Source: OSTI; NTIS; GPO; INIS.

Test VI-7 was the final test in the VI series conducted in the vertical furnace. The fuel specimen was a 15.2-cm-long section of a fuel rod from the Monticello boiling water reactor (BWR). The fuel had experienced a burnup of ~40 Mwd/kg U. It was heated in an induction furnace for successive 20-min periods at 2000 and 2300 K in a moist air-helium atmosphere. Integral releases were 69% for 85Kr, 52% for ^{125}Sb, 71% for both ^{134}Cs and ^{137}Cs, and 0.04% for ^{154}Eu. For the non-gamma-emitting species, release values for 42% for I, 4.1% for Ba, 5.3 % for Mo, and 1.2% for Sr were determined. The total mass released from the furnace to the collection system, including fission products, fuel, and structural materials, was 0.89 g, with 37% being collected on the thermal gradient tubes and 63% downstream on filters. Posttest examination of the fuel specimen indicated that most of the cladding was completely oxidized to ZrO_2, but that oxidation was not quite complete at the upper end. The release behaviors for the most volatile elements, Kr and Cs, were in good agreement with the ORNL-Booth Model.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 20730, 20731, 20744, 20762, 20787, 20967, 21015, 21179, 21207, 21211, 21215, 21216, 21222, 21233, 21295, 21296, 21310, 21311, 21319, 21748, 21786

21257 (ANL/IFR/CP–82924) **Remote, under-sodium fuel handling experience at EBR-II.** King, R.W. (Argonne National Lab., Idaho Falls, ID (United States)); Planchon, H.P. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950311–2: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95011958. Source: OSTI; NTIS; INIS; GPO Dep.

The EBR-II is a pool-type design; the reactor fuel handling components and entire primary-sodium coolant system are submerged in the primary tank, which is 26 feet in diameter, 26 feet high, and contains 86,000 gallons of sodium. Since the reactor is submerged in sodium, fuel handling operations must be performed blind, making exact positioning and precision control of the fuel handling system components essential. EBR-II operated for 30 years, and the fuel handling system has performed approximately 25,000 fuel transfer operations in that time. Due to termination of the IFR program, EBR-II was shut down on September 30, 1994. In preparation for decommissioning, all fuel in the reactor will be transferred out of EBR-II to interim storage. This intensive fuel handling campaign will last approximately two years, and the number of transfers will be equivalent to the fuel handling done over about nine years of normal reactor operation. With this demand on the system, system reliability will be extremely important. Because of this increased demand, and considering that the system has been operating for about 32 years, system upgrades to increase reliability and efficiency are proceeding. Upgrades to the system to install new digital, solid state controls, and to take advantage of new visualization technology, are underway. Future reactor designs using liquid metal coolant will be able to incorporate imaging technology now being investigated, such as ultraviolet laser imaging and ultrasonic imaging.

21258 (ANL/TD/SUMM–85849) **Experiences in the D&D of the EBWR reactor complex at Argonne National Laboratory.** Bhattacharyya, S.K.; Boing, L.E.; Fellhauer, C.R. Argonne National Lab., IL (United States). Feb 1995. 3p. Sponsored by USDOE, Washington, DC (United States). (CONF-950601–12: Annual meeting of the American Nuclear Society (ANS), Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95013713. Source: OSTI; NTIS; INIS; GPO Dep.

EBWR went critical in Dec 1957 at 20 MW(t), was upgraded to 100 MW(t) operation. EBWR was shut down July 1967 and placed in dry lay-up. In 1986, the D&D work was planned in 4 phases: final planning and preparations for D&D, removal of reactor systems, removal of reactor vessel complex, and final decontamination and project closeout. Despite precautions, there was an uptake of ^{241}Am by D&D workers following underwater plasma arc cutting within the pool; the cause was traced to an experimental ^{241}Pu foil (200 μg) that was lost in the mid-1960s in the reactor vessel. Several major lessons were learned from this episode, among which is the fact that research facilities often involve unusual experiments which may not be recorded. Safety analysis and review procedure for D&D operations need to be carefully considered since they represent considerably different situations than reactor operations. EBWR is one of the very few cases of a prototypic reactor facility designed, operated, tested and now D&D'd by one organization.

21259 (BNL–52433-Rev.12/94-Vol.1) **Advanced Neutron Source enrichment study – Volume 1: Main report. Final report, Revision 12/94.** Bari, R.A. (Brookhaven National Lab., Upton, NY (United States). Dept. of Advanced Technology); Ludewig, H.; Weeks, J. Brookhaven National Lab., Upton, NY (United States). 31 Dec 1994. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95011615. Source: OSTI; NTIS; INIS; GPO Dep.

A study has been performed of the impact on performance of using low enriched uranium (20% ^{235}U) or medium enriched uranium (35% ^{235}U) as an alternative fuel for the Advanced Neutron Source, which is currently designed to use uranium enriched to 93% ^{235}U. Higher fuel densities and larger volume cores were evaluated at the lower enrichments in terms of impact on neutron flux, safety, safeguards, technical feasibility, and cost. The feasibility of fabricating uranium silicide fuel at increasing material density was specifically addressed by a panel of international experts on research reactor fuels. The most viable alternative designs for the reactor at lower enrichments were identified and discussed. Several sensitivity analyses were performed to gain an understanding of the performance of the reactor at parametric values of power, fuel density, core volume, and enrichment that were interpolations between the boundary values imposed on the study or extrapolations from known technology. Volume 2 of this report contains 26 appendices containing results, meeting minutes, and fuel panel presentations.

21260 (BNL–52433-Rev.12/94-Vol.2) **Advanced Neutron Source enrichment study. Volume 2: Appendices – Final report, Revision 12/94.** Bari, R.A. (Brookhaven National Lab., Upton, NY (United States). Dept. of Advanced Technology); Ludewig, H.; Weeks, J. Brookhaven National Lab., Upton, NY (United States). 31 Dec 1994. 592p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95011616. Source: OSTI; NTIS; INIS; GPO Dep.

A study has been performed of the impact on performance of using low enriched uranium (20% ^{235}U) or medium enriched uranium (35% ^{235}U) as an alternative fuel for the Advanced Neutron Source, which is currently designed to use uranium enriched to 93% ^{235}U. Higher fuel densities and larger volume cores were evaluated at the lower enrichments in terms of impact on neutron flux, safety, safeguards, technical feasibility, and cost. The feasibility of fabricating uranium silicide fuel at increasing material density was specifically addressed by a panel of international experts on research reactor fuels. The most viable alternative designs for the reactor at lower enrichments were identified and discussed. Several sensitivity analyses were performed to gain an understanding of the performance of the reactor at parametric values of power, fuel density, core volume, and enrichment that were interpolations between the boundary values imposed on the study or extrapolations from known technology. Volume 2 of this report contains 26 appendices containing results, meeting minutes, and fuel panel presentations. There are 26 appendices in this volume.

21261 (BNL–61645) **The High Flux Beam Reactor at Brookhaven National Laboratory.** Shapiro, S.M. Brookhaven National Lab., Upton, NY (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-941144–151: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95011401. Source: OSTI; NTIS; INIS; GPO Dep.

Brookhaven National Laboratory's High Flux Beam Reactor (HFBR) was built because of the need of the scientist to always want 'more'. In the mid-50's the Brookhaven Graphite reactor was churning away producing a number of new results when the current generation of scientists, led by Donald Hughes, realized the need for a high flux reactor and started down the political, scientific and engineering path that led to the BFBR. The effort was joined by a number of engineers and scientists among them, Chernick, Hastings, Kouts, and Hendrie, who came up with the novel design of the HFBR. The two innovative features that have been incorporated in nearly all other research reactors built since are: (i) an under moderated core arrangement which enables the thermal flux to peak outside the core region where beam tubes can be placed, and (ii) beam tubes that are tangential to the core which decrease the fast neutron background without affecting the thermal beam intensity. Construction began in the fall of 1961 and four years later, at a cost of $12 Million, criticality was achieved on Halloween Night, 1965. Thus began 30 years of scientific accomplishments.

21262 (CONF-950928–1) **Flow excursion time scales in the Advanced Neutron Source Reactor.** Sulfredge, C.D. Oak Ridge National Lab., TN (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international topical meeting on nuclear reactor thermal-hydraulics (NURETH-7); Saratoga Springs, NY

(United States); 10-15 Sep 1995. Order Number DE94018040. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. RESEARCH AND TEST REACTORS/ reactor channels; REACTOR CHANNELS/fluid flow; REACTOR COOLING SYSTEMS; TWO-PHASE FLOW; HEAT TRANSFER; HYDRAULICS; HEAT FLUX; BUBBLES; VOIDS; FUEL PLATES

21263 (DOE/ER/12972–T2) **UIUC reactor support equipment upgrade.** Holm, R.L. Illinois Univ., Urbana, IL (United States). Nuclear Reactor Lab. 1 Nov 1994. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER12972. Order Number DE95012415. Source: OSTI; NTIS; GPO Dep.

The FY94 grant was used for the purchase of 3 digital area radiation monitors to replace an aging (+30 years) Tracerlab system. Funds were also available for the purchase of items to construct an underwater camera. These items have all been purchased and are installed/constructed. The underwater camera will be of great use when fuel inspections are performed at the beginning of the year.

21264 (DPW–56-7-4) **Savannah River Plant 100 Area reactors monthly report, April 1956.** Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 May 1956. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012030. Source: OSTI; NTIS; GPO Dep.

This monthly report details activities of the Manufacturing Division for the month of April 1956.

21265 (DUN–525-3) **Status of irradiations performed by testing for PNL as of December 10, 1965.** Ferguson, J.H. Douglas United Nuclear, Inc., Richland, WA (United States). 14 Mar 1966. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012762. Source: OSTI; NTIS; GPO Dep.

This document presents details of irradiations performed for PNL as of January 13, 1966.

21266 (DUN–777) **Interlaboratory Neutron Flux Spectral Measurement Program.** DeMers, A.E. Douglas United Nuclear, Inc., Richland, WA (United States). 7 Mar 1966. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012653. Source: OSTI; NTIS; GPO Dep.

This report details an interlaboratory cooperative study undertaken on neutron flux spectral measurements, calculations, and data correlation for reactor irradiation and physics study by various sites. The Testing portion of this study was the irradiation of a wide variety of flux monitors in a special snout capsule holder. The attached sketch shows the capsule holder design, facility design, and the capsule position in relation to adjacent process tubes. A summary of the irradiations performed is provided.

21267 (DUN–2011) **Douglas United Nuclear Inc. monthly report, January 1967.** Douglas United Nuclear, Inc., Richland, WA (United States). 15 Feb 1967. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013942. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of February 1967.

21268 (DUN–2347) **Status of special reactor process tube loadings, April 1, 1967.** Walton, R.P. Douglas United Nuclear, Inc., Richland, WA (United States). 11 Apr 1967. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012651. Source: OSTI; NTIS; GPO Dep.

This document shows the status of production test control tube loadings (at Hanford) in reactor process tubes containing significant amounts of SS materials. This information is entirely numerical and is presented in the form of computer printouts. For additional information on the column headings and the current discharge goal plan, refer to document DUN-1048.

21269 (DUN–2424) **Douglas United Nuclear, Inc. monthly report, April 1967.** Douglas United Nuclear, Inc., Richland, WA (United States). 15 May 1967. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013920. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of April 1967.

21270 (DUN–4452) **Douglas United Nuclear, Inc. monthly report, September 1968.** Douglas United Nuclear, Inc., Richland, WA (United States). 16 Oct 1968. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013915. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of September 1968.

21271 (DUN–4562) **Status of special reactor process tube loadings, August 9, 1968.** Walton, R.P. Douglas United Nuclear, Inc., Richland, WA (United States). 9 Aug 1968. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012655. Source: OSTI; NTIS; GPO Dep.

This document provides the status of production tests control tube loadings in reactor process tubes containing significant amounts of SS material.

21272 (DUN–4699) **Status of special reactor process tube loadings, September 1, 1968.** Walton, R.P. Douglas United Nuclear, Inc., Richland, WA (United States). 10 Sep 1968. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012635. Source: OSTI; NTIS; GPO Dep.

This report provides the status of production tests control tube loadings in reactor process tubes containing significant amounts of SS material.

21273 (DUN–4812) **Douglas United Nuclear, Inc. monthly report, November 1968.** Douglas United Nuclear, Inc., Richland, WA (United States). 18 Dec 1968. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013919. Source: OSTI; NTIS; GPO Dep.

This report presents the details of the activities of Douglas United Nuclear at the Hanford site during the month of November 1968.

21274 (DUN–5253) **Irradiation history of the structural steel specimens for the NRL.** Zimmerman, P.J. Douglas United Nuclear, Inc., Richland, WA (United States). 8 Jan 1969. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012609. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/irradiation; STEELS/irradiation; IRRADIATION; STEELS; NEUTRON FLUENCE; NAVAL RESEARCH LABORATORY; PRODUCTION

21275 (DUN–5430) **Status of special reactor process tube loadings, February 1, 1969.** Walton, R.P. Douglas United Nuclear, Inc., Richland, WA (United States). 11 Feb 1969. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012697. Source: OSTI; NTIS; GPO Dep.

This report presents details of the status of special reactor process tube loadings for the month of February 1969.

21276 (DUN–5611) **Douglas United Nuclear monthly report, May 1969.** Douglas United Nuclear, Inc., Richland, WA (United States). 16 Jun 1969. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013914. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of May 1969.

21277 (DUN–5612) **Douglas United Nuclear monthly report June 1969.** Douglas United Nuclear, Inc., Richland, WA (United States). 16 Jul 1969. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013913. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of June 1969.

21278 (DUN–6270) **Douglas United Nuclear monthly report, October 1969.** Douglas United Nuclear, Inc., Richland, WA (United States). 18 Nov 1969. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013923. Source: OSTI; NTIS; GPO Dep.

This report presents the details of the activities of Douglas United Nuclear at the Hanford site during the month of October 1969.

21279 (DUN–6271) **Douglas United Nuclear monthly report, November 1969.** Westinghouse Hanford Co., Richland, WA (United States). 18 Dec 1969. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013922. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of November 1969.

21280 (DUN–6272) **Douglas United Nuclear, Inc. monthly report, December 1969.** Douglas United Nuclear, Inc., Richland, WA (United States). 16 Jan 1970. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013921. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of December 1969.

21281 (DUN–6485) **Calorimetric assay of ^{60}Co sources from C-overbore facilities.** Sowa, K.B. Douglas United Nuclear, Inc., Richland, WA (United States). 18 Dec 1969. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012637. Source: OSTI; NTIS; GPO Dep.

Cobalt irradiations were completed in two C-Reactor overbore tubes in support of Mission and Program investigations of isotope production. Tubes 1459 and 464 were each charged with approximately 4015 grams of cobalt in strips similar to BNL pieces described in a separate report. After discharge, the strips were placed in an underwater calorimeter to determine the heat contribution from isotopic decay, thereby allowing an assay of cobalt-60 concentrations. The cobalt-60 produced in tube 1464-C was retained by Douglas United Nuclear for source material in an underwater gamma irradiator at KE-Reactor; the remaining cobalt, from tube 1459-C, was shipped to Battelle-Northwest for further experiments and applications. A total of 396,400 Ci of cobalt-60 was produced in tube 1459-C and 272,700 Ci in tube 1464-C during the irradiations. Production in tube 1459-C occurred at the rate of 0.637 Ci/gm per 100 MWd/T of adjacent tube power; production in tube 1464-C occurred at the rate of 0.670 Ci/gm per 100 MWd/T of adjacent tube power. The total irradiation time was 880.813 full power days for tube 1459-C and 569.010 full power days for tube 1464-C.

21282 (DUN–7740) **Douglas United Nuclear monthly report, July 1971.** Douglas United Nuclear, Inc., Richland, WA (United States). 20 Jul 1971. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014067. Source: OSTI; NTIS; GPO Dep.

This report presents details of the activities of Douglas United Nuclear at the Hanford site during the month of July 1971.

21283 (DUN–7741) **Douglas United Nuclear monthly report, August 1971.** Douglas United Nuclear, Inc., Richland, WA (United States). [1971]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014066. Source: OSTI; NTIS; GPO Dep.

This report presents the details of the activities of Douglas United Nuclear at the Hanford site during the month of August 1971.

21284 (DUN-AOP–213) **Hanford toll irradiation study.** Woods, W.K. Westinghouse Hanford Co., Richland, WA (United States). 2 Sep 1969. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012711. Source: OSTI; NTIS; GPO Dep.

This report presents details of the Hanford toll irradiation study. The objective of the study was to provide a basis for establishing charges for irradiation of neptunium for private parties on a toll basis.

21285 (JAERI-Research–95-005) **Analysis of energy deposition and evaluation of maximum load of irradiation capsule for NSRR experiment with uranium-zirconium hydride fuel.** Fuketa, Toyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Ishijima, Kiyomi; Tanzawa, Sadamitsu; Nakamura, Takehiko; Sasajima, Hideo; Kashima, Youichi; Toyokawa, Shunji; Kobayashi, Shinsho. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1995. 61p. (In Japanese). Order Number DE95780484. Source: OSTI; NTIS; INIS.

The new experiment plan is progressing to perform the NSRR pulse-irradiation experiment with uranium-zirconium hydride ($U\text{-}ZrH_x$) fuel which is widely utilized in the world as TRIGA reactor fuel. The uranium-zirconium hydride is a first test specimen as metallic fuel in the NSRR experiment, and has a number of individual properties, e.g. hydrogen dissociation. This report summarizes the properties of uranium-zirconium hydride fuel, and presents analysis of energy deposition during the pulse irradiation and evaluation of maximum load to test vessel, i.e. pressure pulse and mechanical forces, during the experiment. Neutronic calculation indicates that fuel temperature reaches its melting point during the pulse in the NSRR. The consideration on several aspects, including burst failure of cladding tube at low temperature, expansion of released hydrogen in the capsule and molten fuel/coolant interactions, gives predicted maximum pressure and mechanical work during the experiment. The results of maximum load evaluation will be applied for design of irradiation capsule. A relatively large safety margin has been needed for design of the uranium-zirconium hydride fuel, since information of fuel behavior during off-normal conditions is limited so far. The NSRR experiment with the uranium-zirconium hydride fuel will realize precise safety evaluation, and improve the TRIGA reactor performance. The data to be obtained in this program will also contribute development of next-generation TRIGA reactor and its safety evaluation. (author).

21286 (JAERI-Research–95-022) **Estimation of subcriticality by neutron source multiplication method.** Sakurai, Kiyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Suzaki, Takenori; Arakawa, Takuya; Naito, Yoshitaka. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 56p. (In Japanese). Order Number DE95780612. Source: OSTI; NTIS; INIS.

Subcritical cores were constructed in a core tank of the TCA by arraying 2.6% enriched UO_2 fuel rods into nxn square lattices of 1.956 cm pitch. Vertical distributions of the neutron count rates for the fifteen subcritical cores (n=17, 16, 14, 11, 8) with different water levels were measured at 5 cm interval with ^{235}U micro-fission counters at the in-core and out-core positions arranging a $^{252}C_f$ neutron source at near core center. The continuous energy Monte Carlo code MCNP-4A was used for the calculation of neutron multiplication factors and neutron count rates. In this study, important conclusions are as follows: (1) Differences of neutron multiplication factors resulted from exponential experiment and MCNP-4A are below 1% in most cases. (2) Standard deviations of neutron count rates calculated from MCNP-4A with 500000 histories are 5-8%. The calculated neutron count rates are consistent with the measured one. (author).

21287 (JAERI-Research–95-026) **Development of maintenance engineering system.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 60p. (In Japanese). Order Number DE95780614. Source: OSTI; NTIS; INIS.

Department of JMTR project has developed the Maintenance Engineering System which evaluates the aging tendency of the facilities. The system is used for the repair plan and the replace period of parts, components, equipments or facilities. The system has the data-base which consists of the check data, the inspection data, the trouble data and the repair data at the JMTR since the virgin criticality. The system is utilized maintenance works and concludes the maintenance procedures for the failure components, equipments and facilities. This system has the following characteristics. (1) Anybody can operate the system as easily as word processor. (2) Data are put into by man-machine-interface. (3) The data sheets are with light color and the recognizable arrangements. (4) The system is cost-efficient using commercial personal computers and applications. The research card and the layouts of the

input data sheet had been formatted. Data has been begun to be put into the system and to check its functions. The result demonstrates that the system is available for preventive maintenance at the JMTR. (author).

21288 (JAERI-Tech–95-001) **Water chemistry management in cooling system of research reactor in JAERI.** Suparit, N. (Office of Atomic Energy for Peace, Bangkok (Thailand)); Yoshijima, Tetsuo; Tanaka, Sumitoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 66p. Order Number DE95780586. Source: OSTI; NTIS; INIS.

The department of research reactor presently operates three research reactors (JRR-2, JRR-3M and JRR-4). For controlling and management of water and gas in each research reactor are performed by the staffs of the research reactor technology development division. Water chemistry management of each research reactor is one of the important subject. The main objects are to prevent the corrosion of water cooling system and fuel elements, to suppress the plant radiation build-up and to minimize the radioactive waste. In this report describe a outline of each research reactor facilities, radiochemical analytical methods and chemical analytical methods for water chemistry management. (author).

21289 (LA-SUB–94-72) **Los Alamos National Laboratory Omega West Reactor restart.** Los Alamos National Lab., NM (United States); Burns and Roe Utility Management Consultants, Gales Ferry, CT (United States). 27 Aug 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011064. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a critical evaluation of the effort for the restart of the Omega West reactor. It is divided into the following areas: progress made; difficulties in restart effort; current needs; and suggested detailed steps for improvement. A brief discussion is given for each area of study.

21290 (PNL-D–375) **Operations Security Assessment of the Department of Energy's Richland Operation Office, Final Report (SAS-4394-HQ).** Merrill, B.J. Pacific Northwest Lab., Richland, WA (United States). 5 Oct 1984. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012660. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD RESERVATION/security; SECURITY; TRAINING; CONTRACTORS; PROGRESS REPORT

21291 (WHC-SD-FF-ANAL–003) **Snubber reduction analysis of secondary hot leg.** Chen, W.W. Westinghouse Hanford Co., Richland, WA (United States). 14 Apr 1995. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010737. Source: OSTI; NTIS; INIS; GPO Dep.

The analysis is to verify the structural integrity of the Secondary Hot Leg Dump Heat Exchanger piping system of Fast Flux Test Facility (FFTF) under seismic loading after the deletion of seismic snubbers. ADLPIPE computer code was used to perform the analyses. Results of the piping stress analysis with snubber reduction are qualified in accordance with ASME Section II Class 1 requirements. The effects of inelastic strain accumulation, creep-fatigue damage and interaction, and elastic follow-up are evaluated. Anchor and hanger loads are evaluated by comparing with those from qualified seismic report.

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Refer also to citation(s) 21015, 21182, 21190, 21230, 21238, 21255, 21753, 21754, 22400

21292 (BNL–61649) **Evaluation of single failure effects during loss of coolant accidents for a VVER-440 reactor.** Shier, W.; Kohut, P.; Horak, W. Brookhaven National Lab., Upton, NY (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950426–3: 3. international conference on nuclear engineering, Kyoto (Japan), 23-27 Apr 1995). Order Number DE95011402. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the results of an analysis of loss of coolant accidents (LOCA's) for the Soviet designed, light water cooled and moderated reactors referred to as VVERS. The VVER unit selected for this analysis is designated as VVER-440 Model 213. This plant generates 440 MWe and is of current interest since fifteen are now operating and additional units are in various stages of construction within Eastern Europe and the New Independent States. In addition to the analysis of two base case LOCA'S, this paper also presents the results of several sensitivity studies related to single failures in various plant systems that have been included in the design to mitigate the effects of LOCA's on plant and fuel system performance. Examples of the safety systems selected for these sensitivity studies include the scram system, the accumulators, and the high pressure injection system.

21293 (BNL-NUREG–60573) **Mixing phenomena of interest to boron dilution during small break LOCAs in PWRs.** Nourbakhsh, H.P.; Cheng, Z. Brookhaven National Lab., Upton, NY (United States). [1995]. 17p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CONF-950904–5: 7. international meeting on nuclear reactor thermal hydraulics, Saratoga, NY (United States), 10-15 Sep 1995). Order Number DE95008862. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of a study of mixing phenomena related to boron dilution during small break loss of coolant accidents (LOCAs)in pressurized water reactors (PWRs). Boron free condensate can accumulate in the cold leg loop seals when the reactor is operating in a reflux/boiler-condenser mode. A problem may occur when subsequent change in flow conditions such as loop seal clearing or re-establishment of natural circulation flow drive the diluted water in the loop seals into the reactor core without sufficient mixing with the highly borated water in the reactor downcomer and lower plenum. The resulting low boron concentration coolant entering the core may cause a power excursion leading to fuel failure. The mixing processes associated with a slow moving stream of diluted water through the loop seal to the core are examined in this paper. Bounding calculations for boron concentration of coolant entering the core during a small break LOCA in a typical Westinghouse-designed four-loop plant are also presented.

21294 (CEA-CONF–11828) **Reflood modeling under oscillatory flow conditions with Cathare.** Kelly, J.M.; Bartak, J.; Janicot, A. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Thermohydraulique et de Physique. 1993. 25p. (CONF-931005–: 6. international topical meeting on nuclear reactor thermal hydraulics, Grenoble (France), 5-8 Oct 1993). Order Number DE95631673. Source: OSTI; NTIS (US Sales Only); INIS.

The problems and the current status in oscillatory reflood modelling with the CATHARE code are presented. The physical models used in CATHARE for reflood modelling predicted globally very well the forced reflood experiments. Significant drawbacks existed in predicting experiments with oscillatory flow (both forced and gravity driven). First, the more simple case of forced flow oscillations was analyzed. Modelling improvements within the reflooding package resolved the problem of quench front blockages and unphysical oscillations. Good agreements with experiment for the ERSEC forced oscillations reflood tests is now obtained. For gravity driven reflood, CATHARE predicted sustained flow oscillations during 100-150 s after the start of the reflood, whereas in the experiment flow oscillations were observed only during 25-30 s. Possible areas of modeling improvements are identified and several new correlations are suggested. The first test calculations of the BETHSY test 6.7A4 have shown that the oscillations are mostly sensitive to heat flux modeling downstream of the quench front. A much better agreement between CATHARE results and the experiment was obtained. However, further effort is necessary to obtain globally satisfactory predictions of gravity driven system reflood tests. (authors) 6 figs., 35 refs.

21295 (CONF-9506121–1) **Monte Carlo verification of point kinetics for safety analysis of nuclear reactors.** Valentine, T.E. (Oak Ridge National Lab., TN (United States). Instrumentation and Controls Div.); Mihalczo, J.T. Oak Ridge National Lab., TN (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international symposium on nuclear reactor surveillance and diagnostics;

Avignon (France); 19-23 Jun 1995. Order Number DE95012846. Source: OSTI; NTIS; INIS; GPO Dep.

Monte Carlo neutron transport methods can be used to verify the applicability of point kinetics for safety analysis of nuclear reactors. KENO-NR was used to obtain the transfer function of the Advanced Neutron Source reactor and the time delay between the core power production and the external detectors, a parameter of interest to the safety systems design. The good agreement between the Monte Carlo generated transfer function and the point kinetics transfer function validates that the uncommon ANS geometry does not preclude the use of point kinetics in the frequency range that was investigated. Various features of the power spectral densities also demonstrated the applicability of point kinetics. The time delay was obtained from the cross-power spectral density (CPSD) and is ~15 ms. These analyses show that frequency analysis can be used experimentally to investigate the validity of the use of point kinetics models in critical experiments or zero power testing of reactors.

21296 (CONF-950904–4) **Flow excursion time scales in the advanced neutron source reactor.** Sulfredge, C.D. Oak Ridge National Lab., TN (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international meeting on nuclear reactor thermal hydraulics; Saratoga, NY (United States); 10-15 Sep 1995. Order Number DE95009181. Source: OSTI; NTIS; INIS; GPO Dep.

Flow excursion transients give rise to a key thermal limit for the proposed Advanced Neutron Source (ANS) reactor because its core involves many parallel flow channels with a common pressure drop. Since one can envision certain accident scenarios in which the thermal limits set by flow excursion correlations might be exceeded for brief intervals, a key objective is to determine how long a flow excursion would take to bring about a system failure that could lead to fuel damage. The anticipated time scale for flow excursions has been examined by subdividing the process into its component phenomena: bubble nucleation and growth, deceleration of the resulting two-phase flow, and finally overcoming thermal inertia to heat up the reactor fuel plates. Models were developed to estimate the time required for each individual stage. Accident scenarios involving sudden reduction in core flow or core exit pressure have been examined, and the models compared with RELAP5 output for the ANS geometry. For a high-performance reactor like the ANS, flow excursion time scales were predicted to be in the millisecond range, so that even very brief transients might lead to fuel damage. These results should prove useful whenever one must determine the time involved in any portion of a flow excursion transient.

21297 (CONF-9509162–1) **Thorium: Uranium fuel cycle in safe reactors, the time is now.** Gat, Uri. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9504164–1: Global '95; Roane/Anderson Professional Society meeting, Versailles (France); Oak Ridge, TN (United States), 11 Sep 1995; 12 apr 1995). Order Number DE95012297. Source: OSTI; NTIS; INIS; GPO Dep.

The thorium-uranium fuel cycle has several advantages that make it attractive. Some of these beneficial properties are of particular interest now as they help alleviate current concerns. The Th-U cycle has neutronic advantages when utilized in thermal or epithermal reactors. Some of these reactors enjoy extraordinary safety qualities. The combination of these traits suggest that now is an appropriate time to deploy and begin exploiting the Th-U fuel cycle.

21298 (DOE/ER/12815–T1-Pt.1) **Model development for the dynamic analysis of the OSU inherently safe reactor. Part 1.** Aybar, H.S. Ohio State Univ. Research Foundation, Columbus, OH (United States). 1992. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER12815. Order Number DE95009692. Source: OSTI; NTIS; INIS; GPO Dep.

Faculty and students in the Nuclear Engineering Program at the Ohio State University (OSU) have proposed a conceptual design for an inherently safe 340 MWe power reactor. The design is based on the state-of-the-art technology of LWRs and the High Temperature Gas- cooled Reactors (HTGRs). The OSU Inherently Safe Reactor (OSU-ISR) concept uses shorter than standard BWR fuel elements in the reactor core. All the fluid on the primary side is contained within a Prestressed Concrete Reactor Vessel (PCRV). This important feature significantly reduces the probability of a LOCA. A new feature of the OSU-ISR is an operator independent steam driven Emergency Core Cooling System (ECCS) housed within the PCRV. In accident conditions where the steam generators are incapacitated, steam from the core drives a jet injector, which takes water from the suppression pool and pumps it into the core cavity to maintain core coverability. The preliminary analysis of the concept was performed as a design project in the Nuclear Engineering Program at the OSU during the Spring of 1985, and published in "Nuclear Technology." The use of a PCRV for ducting and containment and the replacement of forced recirculation with natural circulation on the primary side significantly improve the inherent safety of the plant. Currently, work is in progress for the refinement of the OSU-ISR concept, partially supported by a grant from the U.S. Department of Energy.

21299 (DOE/ER/12815–T1-Pt.2) **Phenomenological and mathematical modeling of a high pressure steam driven jet injector. Part 2.** Anand, G. Ohio State Univ. Research Foundation, Columbus, OH (United States). 1993. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER12815. Order Number DE95012601. Source: OSTI; NTIS; INIS; GPO Dep.

An injector is a particular type of jet pump which uses condensable vapor to entrain a liquid and discharge against a pressure higher than either motive or suction pressures. The injector has no moving parts and requires no external power supply nor any complex control system. Thus, the injector is particularly suited for emergency core cooling operations. A detailed survey has indicated that various injector designs are available for operating pressures below 250 psig. However, the design of these injectors from the viewpoint of a basic understanding of heat and mass transfer processes has not been well developed. A critical review of the models showed serious discrepancies between the analytical models and the experimental observations. The discrepancies evolved from the neglect of non-equilibrium aspects of the flow. The origin of the non-equilibrium aspects can be traced to the extremely small time scales governing the flow in the injector. Thus, time scales of the order of 10^{-2} seconds are involved in the injector, accompanied by mass, momentum, and heat transfer rates of orders of magnitude higher than that observed in conventional two-phase flows. The present study focuses on the phenomenological and mathematical modeling of the processes in the injector from the viewpoint of its non-equilibrium nature.

21300 (DOE/ER/12815–T1-Pt.3) **Probabilistic assessment of dynamic system performance. Part 3.** Belhadj, M. Ohio State Univ. Research Foundation, Columbus, OH (United States). 1993. 378p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER12815. Order Number DE95012602. Source: OSTI; NTIS; INIS; GPO Dep.

Accurate prediction of dynamic system failure behavior can be important for the reliability and risk analyses of nuclear power plants, as well as for their backfitting to satisfy given constraints on overall system reliability, or optimization of system performance. Global analysis of dynamic systems through investigating the variations in the structure of the attractors of the system and the domains of attraction of these attractors as a function of the system parameters is also important for nuclear technology in order to understand the fault-tolerance as well as the safety margins of the system under consideration and to insure a safe operation of nuclear reactors. Such a global analysis would be particularly relevant to future reactors with inherent or passive safety features that are expected to rely on natural phenomena rather than active components to achieve and maintain safe shutdown. Conventionally, failure and global analysis of dynamic systems necessitate the utilization of different methodologies which have computational limitations on the system size that can be handled. Using a Chapman-Kolmogorov interpretation of system dynamics, a theoretical basis is developed that unifies these methodologies as special cases and which can be used for a comprehensive safety and reliability analysis of dynamic systems.

21301 (DOE/ER/12900–T1) **Breakup of metal jets penetrating a volatile liquid. Final report, October 1, 1991–February 28, 1993.** Schneider, J.P. Illinois Univ., Urbana, IL (United States).

Dept. of Nuclear Engineering. [1995]. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER12900. Order Number DE95014740. Source: OSTI; NTIS; GPO Dep.

In a loss of coolant accident, the core may become uncovered, causing the fuel pins to melt. The molten fuel would pour onto the plenum and collect on the reactor pressure vessel (RPV) lower head. The RPV internal structure includes one or more perforated plates in the lower plenum which would divide the molten fuel into small diameter streams or jets, which would break up as they penetrate the coolant in the lower plenum. The breakup of these jets would occur in two phases, each dominated by a distinct fragmentation mechanism. As a fuel jet first penetrates the coolant, a stagnation flow develops at its leading edge, causing the column to spread radially and eject molten fuel into the coolant. The jet fluid in the column is fragmented by pressure fluctuations due to the jet/ambient fluid relative motion, so that a steady jet is reduced to a field of falling drops below a critical depth called the breakup length. The present work includes analyses yielding simple correlations for jet breakup length and jet leading edge penetration.

21302 (DOE/ER/12900–T2) **Experimental observations of the breakup of multiple metal jets in a volatile liquid.** Marciniak, M.J. Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering. [1995]. 143p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER12900. Order Number DE95015001. Source: OSTI; NTIS; GPO Dep.

A postulated severe loss of coolant accident in a nuclear reactor can lead to significant core damage due to residual heat generation. Subsequently, melted core materials (i.e.; corium) could migrate downward and impinge upon the lower head of the reactor pressure vessel (RPV). During this relocation, the complexity of the reactor structure could segregate the molten corium into various flow paths. A perforated flow plate could readily provide the mechanism to segregate the molten corium. The resulting small (a few cm) diameter melt streams, driven by gravity, could then penetrate the remaining coolant in the RPV and cause any of the following events: impingement of the high temperature melt streams on the lower head could breach the RPV; re-agglomeration of the corium melt on the lower head could influence the coolability of the debris bed; "pre-mixing" of the melt streams with the coolant could lead to a vapor explosion; or, sufficient quenching of the melt streams by the coolant could produce a stabilized debris bed. An overview of the thermo-science issues related to core-melt accidents is presented by Theofanous. Thus, insight into the melt stream breakup mechanisms (i.e.; interfacial conditions, fragmentation, and geometric spacing) during the melt-coolant interactions is necessary to evaluate the plausibility, and characteristics, of these events. Molten Fuel Stream Breakup Simulation (MFSBS) experiments have been performed at Argonne National Laboratory in which simulant materials were used to determine a 'boiling' jet breakup length correlation and to visualize the melt fragmentation mechanisms during the penetration of a single molten metal jet into a volatile liquid. The goal was to characterize the hydrodynamics of the corium-water interactions in a postulated core melt accident. The present experiment closely follows the procedures of the MFSBS.

21303 (DOE/ID–10489) **The study of steam explosions in nuclear systems. Advanced Reactor Severe Accident Program.** Theofanous, T.G. (California Univ., Santa Barbara, CA (United States). Center for Risk Studies and Safety); Yuen, W.W.; Angelini, S.; Chen, X. USDOE Idaho Operations Office, Idaho Falls, ID (United States); California Univ., Santa Barbara, CA (United States). Center for Risk Studies and Safety. Jan 1995. 425p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95010681. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents an overview of the steam explosion issue in nuclear reactor safety and our approach to assessing it. Key physics, models, and computational tools are described, and illustrative results are presented for ex-vessel steam explosions in an open pool geometry. An extensive set of appendices facilitate access to previously reported work that is an integral part of this effort. These appendices include key developments in our approach, key advances in our understanding from physical and numerical experiments, and details of the most advanced computational results presented in this report. Of major significance are the following features: A consistent two-dimensional treatment for both premixing and propagation which in practical settings are ostensibly at least two-dimensional phenomena; experimental demonstration of voiding and microinteractions which represent key behaviors in premixing and propagation respectively; demonstration of the explosion venting phenomena in open pool geometries which, therefore, can be counted on as a very important mitigative feature; and introduction of the idea of penetration cutoff as a key mechanism prohibiting large-scale premixing in usual ex-vessel situations involving high pour velocities and subcooled pools. This report is intended as an overview and is to be followed by code manuals for PM-ALPHA and ESPROSE.m, respective verification reports, and application documents for reactor-specific applications. The applications will employ the Risk Oriented Accident Analysis Methodology (ROAAM) to address the safety importance of potential steam explosions phenomena in evaluated severe accidents for passive Advanced Light Water Reactors (ALWRs).

21304 (DOE/NV–367) **FRMAC-93 lessons learned report.** Kerns, K.C. (comp.). EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Mar 1994. 49p. Sponsored by USDOE, Washington, DC (United States);Federal Emergency Management Agency, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC08-93NV11265. Order Number DE95012785. Source: OSTI; NTIS; INIS; GPO Dep.

FRMAC-93 simulated a radiological accident at the Fort Calhoun nuclear power plant, 25 miles north of Omaha, Nebraska. The exercise involved the state Iowa and Nebraska, NRC as the lead Federal agency, FRMAC (Federal Radiological Monitoring and Assessment Center), and several federal agencies with statutory emergency responsibility. FRMAC-93 was a major 2-day field exercise designed to determine the effectiveness, coordination, and operations of a DOE-managed FRMAC. Other objectives were to ensure that appropriate priorities were established and assistance was provided to the states and the lead Federal agency by FRMAC. Day 1 involved the Fort Calhoun evaluated plume phase exercise. On Day 2, the flow of data, which was slow initially, improved so that confidence of states and other federal responders in FRMAC support capabilities was high. The impact and lessons learned from FRMAC-93 provided the necessary impetus to make organizational and operational changes to the FRMAC program, which were put into effect in the DOE exercise FREMONT at Hanford 3 months later.

21305 (GRS–110) **17. meeting of the Society for Reactor Safety. Proceedings.** Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Garching (Germany). Jun 1994. 77p. (In German). (CONF-9310338–: 17. meeting of the Society for Reactor Safety, Koeln (Germany), 6-7 Oct 1993). Order Number DE95780099. Source: OSTI; NTIS (US Sales Only); INIS.

An autonomous and independent reactor safety research in Germany is indispensable. Three out of the four papers of the meeting deal with the protective aim concept of NPP. Deterministic safety assessment during periodic in-service inspections, a new generation of information engineering, and the incorporation of serious accidents in the containment design of new reactors are considered in detail. (DG)

21306 (GRS–110, pp. 7-26) **The protective aim concept - a proposal for deterministic safety assessment during periodic in-service inspections of nuclear power plants.** Mertins, M. (Gesellschaft fuer Reaktorsicherheit (Greece), Koeln (Germany). Bereich Betriebsverhalten); Rittig, D. Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Garching (Germany). Jun 1994. 77p. (In German). (CONF-9310338–: 17. meeting of the Society for Reactor Safety, Koeln (Germany), 6-7 Oct 1993). In *17. meeting of the Society for Reactor Safety. Proceedings.* Order Number DE95780099. Source: OSTI; NTIS (US Sales Only); INIS.

The protective aim concept is a proposal designed to entirely cover the proven "defence-in-depth" concept by means of design-independent safety requirements. These requirements are oriented according to the concerns of a uniform safety assessment of existing nuclear power plants. They take into account the safety-relevant data defined in the nuclear set of rules as well as significant recent

findings on safety, and thus characterize the safety level in accordance with the state-of-the-art technology. The crucial importance of representative incidents or states under the protective aim concept, the principles to be observed together with the required minimum barriers, and the plant states with precautionary measures relevant to the different levels are represented. The protective aim concept in normal operation is based on observed incidents. Both here an on the accident level it follows up trends in order to fully utilized also these possibilities of safety improvement. (orig.)

21307 (GRS–110, pp. 27-42) **The new generation of information engineering - improved safety when used in nuclear power plants.** Bastl, W. (Institut fuer Sicherheitstechnologie, Garching (Germany)). Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Garching (Germany). Jun 1994. 77p. (In German). (CONF-9310338–: 17. meeting of the Society for Reactor Safety, Koeln (Germany), 6-7 Oct 1993). In *17. meeting of the Society for Reactor Safety. Proceedings.* Order Number DE95780099. Source: OSTI; NTIS (US Sales Only); INIS.

Based on several examples, the new methods of information technology are shown by which the operator is much better connected to what happens in the plant than he has been so far. Of crucial importance is the transition from system-oriented to task-oriented information made possible by the application of digital technique. By using computer-aided diagnostic and prognostic methods, the mental image of plant events is essentially supported, above all in complex and intricate situations. The safety benefit realizable by this is immeasurable. It results in a gain of time in the assessment of a plant situation; prognoses on possible developments of an incident or support for the application of procedures. (orig.)

21308 (GRS–110, pp. 43-56) **Inclusion of serious accidents in the containment design of new reactors.** Wolfert, K. (Gesellschaft fuer Reaktorsicherheit (Greece), Garching (Germany). Bereich Thermohydraulik); Rohde, J. Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Garching (Germany). Jun 1994. 77p. (In German). (CONF-9310338–: 17. meeting of the Society for Reactor Safety, Koeln (Germany), 6-7 Oct 1993). In *17. meeting of the Society for Reactor Safety. Proceedings.* Order Number DE95780099. Source: OSTI; NTIS (US Sales Only); INIS.

The area of beyond design basis accidents was intensely and expansively studied in connection with the introduction of in-plant emergency measures as an additional safety level. Probabilistic safety analyses show impressively the gain in safety realizable by in-plant emergency measures. Research work on the phenomena of serious accidents, including those leading to a complete core meltdown, has been done since the beginning of reactor safety research parallely to studies of the problems involved in design basis accidents. Over the last few years the importance of analyzing accident-related phenomena and their possible consequences has increased. This development has been intensified both by the TMI and Chernobyl reactor accidents and by the demand for taking into account serious accidents in the design of new reactors. Summarizing it is said that available operating experience and findings from research and development projects constitute a well-balanced basis for the development of the new light water reactor. (orig.)

21309 (GRS-F–1/1994) **Reports on research programs in the field of reactor safety sponsored by the Federal Ministry of Research and Technology. Reported period: January 1 to June 30, 1994.** Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Koeln (Gemany). 1994. 309p. (In German). Sponsored by Bundesministerium fuer Bildung, Wissenschaft, Forschung und Technologie, Bonn (Germany). Order Number DE95785362. Source: OSTI; NTIS (US Sales Only); INIS.

Each progress report represents a compilation of individual reports about objectives, the work performed, the results, the next steps of the work etc. The individual reports are prepared in a standard form by the contractors themselves as a documentation of their progress in work and published by the Forschungsbetreuung at the GRS, (FB) (Research Coordination Department), within the framework of general informations of progress in reactor safety research. The individual reports are classified according to the research program of the safety of LWR 1977 - 1980 of the BMFT. Another table of uses the same classification system as applied in the nuclear safety index of the CEC (Commission of the European Communities) and the OECD (Organization for Economic Cooperation and Development). The reports are arranged in sequence of their project numbers. (orig.)

21310 (LA–12556-C, pp. 216-225) **LACEF SAR & accident envelope.** Paternoster, R. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a discussion of the safety analysis report for the Los Alamos LACEF. Status of the SAR was noted, and the accidents analyzed were also noted. These included the maximum consequence accidents and the DBAs for each of the LACEF facilities.

21311 (LA–12556-C, pp. 226-232) **Analysis of accident consequences in support of the preparation of the LACEF safety analysis report.** Hetrick, D.L. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a brief discussion of accident analyses for the following LACEF facilities: (1) WINCO Double Slab Tank geometry on the comet assembly machine; (2) SHEBA; (3) flattop assembly; and (4) CNDS on the MARS assembly machine.

21312 (NUREG–1501) **Background as a residual radioactivity criterion for decommissioning: Appendix A to the Generic Environmental Impact Statement in support of rulemaking on radiological criteria for decommissioning of NRC-licensed nuclear facilities. Draft report.** Huffert, A.M. (Nuclear Regulatory Commission, Washington, DC (United States)); Meck, R.A.; Miller, K.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Aug 1994. 95p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report was originally published as an appendix to the draft U.S. Nuclear Regulatory Commission (NRC) document entitled, "Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for Decommissioning of NRC-Licensed Nuclear Facilities." Because of the great interest in this report by members of the public, citizen and environmental organizations, academicians, licensees, and regulators, the NRC staff is publishing this report separately, so that it can be readily available to a diverse audience. This report was created to assist both the NRC staff and interested members of the public in evaluating background radiation (background) as a decommissioning criterion, by serving as a primer on background and providing information on the existing applications of background in regulatory criteria and standards. This report also discusses some of the methods available to measure and distinguish between the very low radiation levels associated with background and man-made sources of radiation. Two approaches are considered for applying background as a decommissioning criterion; these are the use of background dose rates and background radionuclide concentrations. This report concludes that the temporal and spatial variability of background produces a wide range of doses to United States residents, which prevents the application of background dose rates as a decommissioning criterion. Instead, this report recommends that local background radionuclide concentrations serve as a benchmark for decommissioning criteria, while taking into account the concept of reducing residual radioactivity to a level as low as is reasonably achievable.

21313 (NUREG/CP–0140-Vol.1) **Twenty-second water reactor safety information meeting: Proceedings. Volume 1: Plenary session; Advanced instrumentation and control hardware and software; Human factors research; IPE and PRA.** Monteleone, S. (comp.) (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research;

Brookhaven National Lab., Upton, NY (United States). Apr 1995. 391p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CONF-9410216–Vol.1: 22. water reactor safety information meeting, Bethesda, MD (United States), 24-26 Oct 1994). Source: OSTI; NTIS; GPO; INIS.

This three-volume report contains papers presented at the Twenty-Second Water Reactor Safety Information Meeting held at the Bethesda Marriott Hotel, Bethesda, Maryland, during the week of October 24–26, 1994. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the meeting included papers presented by researchers from Finland, France, Italy, Japan, Russia, and United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

21314 (NUREG/CP–0140-Vol.3) **Twenty-second water reactor safety information meeting: Proceedings. Volume 3: Primary systems integrity; Structural and seismic engineering; Aging research, products and applications.** Monteleone, S. (comp.) (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (United States). Apr 1995. 269p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CONF-9410216–Vol.3: 22. water reactor safety information meeting, Bethesda, MD (United States), 24-26 Oct 1994). Source: OSTI; NTIS; GPO; INIS.

This three-volume report contains papers presented at the Twenty-Second Water Reactor Safety Information Meeting held at the Bethesda Marriott Hotel, Bethesda, Maryland, during the week of October 24–26, 1994. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the meeting included papers presented by researchers from Finland, France, Italy, Japan, Russia, and United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

21315 (NUREG/CR–6109) **The probability of containment failure by direct containment heating in surry.** Pilch, M.M. (Sandia National Labs., Albuquerque, NM (United States)); Allen, M.D.; Bergeron, K.D.; Tadios, E.L.; Stamps, D.W.; Spencer, B.W.; Quick, K.S.; Knudson, D.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Technology; Sandia National Labs., Albuquerque, NM (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States); Argonne National Lab., IL (United States). May 1995. 268p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-94AL85000 ; AC07-94ID13223 ; W-31109-ENG-38. (SAND–93-2078). Source: OSTI; NTIS; GPO; INIS.

In a light-water reactor core melt accident, if the reactor pressure vessel (RPV) fails while the reactor coolant system (RCS) at high pressure, the expulsion of molten core debris may pressurize the reactor containment building (RCB) beyond its failure pressure. A failure in the bottom head of the RPV, followed by melt expulsion and blowdown of the RCS, will entrain molten core debris in the high-velocity steam blowdown gas. This chain of events is called a high-pressure melt ejection (HPME). Four mechanisms may cause a rapid increase in pressure and temperature in the reactor containment: (1) blowdown of the RCS, (2) efficient debris-to-gas heat transfer, (3) exothermic metal-steam and metal-oxygen reactions, and (4) hydrogen combustion. These processes, which lead to increased loads on the containment building, are collectively referred to as direct containment heating (DCH). It is necessary to understand factors that enhance or mitigate DCH because the pressure load imposed on the RCB may lead to early failure of the containment.

21316 (NUREG/CR–6331) **Atmospheric relative concentrations in building wakes.** Ramsdell, J.V. Jr. (Pacific Northwest Lab., Richland, WA (United States)); Simonen, C.A.; Smyth, S.B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Radiation Safety and Safeguards; Pacific Northwest Lab., Richland, WA (United States). May 1995. 127p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–10521). Source: OSTI; NTIS; GPO; INIS.

This report documents the ARCON95 computer code developed for the U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research for use in control room habitability assessments. The document includes a user's guide to the code, a description of the technical basis for the code, and a programmer's guide to the code. The ARCON95 code uses hourly meteorological data and recently developed methods for estimating dispersion in the vicinity of buildings to calculate relative concentrations at control room air intakes that would be exceeded no more five percent of the time. These concentrations are calculated for averaging periods ranging from one hour to 30 days in duration. Relative concentrations calculated by ARCON95 are significantly lower than concentrations calculated using the currently accepted procedure when winds are less than two meters per second. For higher wind speeds, ARCON95 calculates about the same concentrations as the current procedure.

21317 (SAND–94-2949) **Observations and insights from low power and shutdown studies: Grand Gulf Nuclear Power Plant during POS 5 of a refueling outage.** Whitehead, D.W.; Brown, T.D.; Forester, J.A. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010578. Source: OSTI; NTIS; INIS; GPO Dep.

With the recent completion of the documentation of the results from the Grand Gulf Nuclear Power Plant Low Power and Shutdown (LP and S) project funded by the US Nuclear Regulatory Commission (NRC), detailed probabilistic risk assessment (PRA) information from a boiling water reactor (BWR) for a specific time period in LP and S conditions became available for examination. This report contains observations and insights extracted from an examination of: (1) results in the LP and S documentation; (2) the specific models and assumptions used in the LP and S analyses; (3) selected results from the full-power analysis; (4) the experience of the analysts who performed the original LP and S study; and (5) results from sensitivity calculations performed as part of this project to help determine the impact that model assumptions and data values had on the results from the original LP and S analysis. Specifically, this study makes observations on and develops insights from the estimates of core damage frequency and aggregate risk (early fatalities and total latent cancer fatalities) associated with operations during plant operational state (POS) 5 (i.e., basically cold shutdown as defined by Technical Specifications) during a refueling outage for traditional internal events. A discussion of similarities and differences between full power accidents and accidents during LP and S conditions is provided. As part of this discussion, core damage frequency and risks results are presented on a per hour and per calendar year basis, allowing alternative perspectives on both the core damage frequency and risk associated with these two operational states.

21318 (UCRL-CR–117769) **Strong motion duration and earthquake magnitude relationships.** Salmon, M.W. (EQE International, Inc., San Francisco, CA (United States)); Short, S.A.; Kennedy, R.P. Lawrence Livermore National Lab., CA (United States); EQE International, Inc., San Francisco, CA (United States); RPK Structural Mechanics Consulting, Yorba Linda, CA (United States). Jun 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95010685. Source: OSTI; NTIS; INIS; GPO Dep.

Earthquake duration is the total time of ground shaking from the arrival of seismic waves until the return to ambient conditions. Much of this time is at relatively low shaking levels which have little effect on seismic structural response and on earthquake damage potential. As a result, a parameter termed "strong motion duration" has been defined by a number of investigators to be used for the

purpose of evaluating seismic response and assessing the potential for structural damage due to earthquakes. This report presents methods for determining strong motion duration and a time history envelope function appropriate for various evaluation purposes, for earthquake magnitude and distance, and for site soil properties. There are numerous definitions of strong motion duration. For most of these definitions, empirical studies have been completed which relate duration to earthquake magnitude and distance and to site soil properties. Each of these definitions recognizes that only the portion of an earthquake record which has sufficiently high acceleration amplitude, energy content, or some other parameters significantly affects seismic response. Studies have been performed which indicate that the portion of an earthquake record in which the power (average rate of energy input) is maximum correlates most closely with potential damage to stiff nuclear power plant structures. Hence, this report will concentrate on energy based strong motion duration definitions.

21319 (WSRC-MS–94-0356) **Buoyancy-driven flow excursions in fuel assemblies.** Laurinat, J.E.; Paul, P.K.; Menna, J.D. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950904–1: 7. international meeting on nuclear reactor thermal hydraulics, Saratoga, NY (United States), 10-15 Sep 1995). Order Number DE95004401. Source: OSTI; NTIS; INIS; GPO Dep.

A power limit criterion was developed for a postulated Loss of Pumping Accident (LOPA) in one of the recently shut down heavy water production reactors at the Savannah River Site. These reactors were cooled by recirculating moderator downward through channels in cylindrical fuel tubes. Powers were limited to prevent a flow excursion from occurring in one or more of these parallel channels. During full-power operation, limits prevented a boiling flow excursion from taking place. At low flow rates, during the addition of emergency cooling water, buoyant forces reverse the flow in one of the coolant channels before boiling occurs. As power increases beyond the point of flow reversal, the maximum wall temperature approaches the fluid saturation temperature, and a thermal excursion occurs. The power limit criterion for low flow rates was the onset of flow reversal. To determine conditions for flow reversal, tests were performed in a mock-up of a fuel assembly that contained two electrically heated concentric tubes surrounded by three flow channels. These tests were modeled using a finite difference thermal-hydraulic code. According to code calculations, flow reversed in the outer flow channel before the maximum wall temperature reached the local fluid saturation temperature. Thermal excursions occurred when the maximum wall temperature approximately equaled the saturation temperature. For a postulated LOPA, the flow reversal criterion for emergency cooling water addition was more limiting than the boiling excursion criterion for full power operation. This criterion limited powers to 37% of historical levels.

24 POWER TRANSMISSION AND DISTRIBUTION

Refer also to citation(s) 21153, 21172, 21831

2401 Power Systems

Refer also to citation(s) 21152, 21519

21320 (DOE/BP/27938–T1) **Analytical tools to predict distribution outage restoration load. Final project report.** Law, J. Idaho Univ., Moscow, ID (United States). Dept. of Electrical Engineering. 14 Nov 1994. 89p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011461. Source: OSTI; NTIS; GPO Dep.

The main activity of this project has been twofold: (1) development of a computer model to predict CLPU(Cold Load Pickup) and (2) development of a field measurement and analysis method to obtain the input parameters of the CLPU model. The field measurement and analysis method is called the Step-Voltage-Test (STEPV). The Kootenai Electric Cooperative Appleway 51 feeder in Coeur d'Alene was selected for analysis in this project and STEPV tests were performed in winters of 92 and 93. The STEPV data was analyzed (method and results presented within this report) to obtain the Appleway 51 feeder parameters for prediction by the CLPU model. One only CLPU record was obtained in winter 1994. Unfortunately, the actual CLPU was not dramatic (short outage and moderate temperature) and did not display cyclic restoration current. A predicted Appleway 51 feeder CLPU was generated using the parameters obtained via the STEPV measurement/analysis/algorithm method at the same ambient temperature and outage duration as the measured actual CLPU. The predicted CLPU corresponds reasonably well with the single actual CLPU data obtained in winter 1994 on the Appleway 51 feeder.

21321 (DOE/OR/21999–T1) **Department of Energy refurbish power supply/distribution system: Phase 2, Y-12 Plant, Oak Ridge. Project status report No. 40, December 1–31, 1994.** Hayes, Seay, Mattern and Mattern, Roanoke, VA (United States). [1994]. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21999. Order Number DE95012196. Source: OSTI; NTIS; GPO Dep.

A status report on the refurbishing of the power supply and distribution system for the Y-12 Plant is presented. A milestone schedule is included.

2402 Power System Networks, Transmission and Distribution

21322 (CONF-9505196–2) **Reliability of lightning resistant overhead distribution lines.** Tolbert, L.M.; Cleveland, J.T.; Degenhardt, L.J. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1995 industrial and commercial power systems conference; San Antonio, TX (United States); 8-10 May 1995. Order Number DE95008974. Source: OSTI; NTIS; GPO Dep.

An assessment of the 32 year historical reliability of the 13.8 kV electrical distribution system at the Oak Ridge National Laboratory (ORNL) in Tennessee has yielded several conclusions useful In the planning of Industrial power Systems. The system configuration at ORNL has essentially remained unchanged in the last 32 years which allows a meaningful comparison of reliability trends for the plant's eight overhead distribution lines, two of which were built in the 1960's with lightning resistant construction techniques. Meticulous records indicating the cause, duration, and location of 135 electric outages in the plant's distribution system have allowed a reliability assessment to be performed. The assessment clearly shows how differences in voltage construction class, length, age, and maximum elevation above a reference elevation influence the reliability of overhead power distribution lines. Comparisons are also made between the ORNL historical data and predicted failure rates from ANSI and IEEE industry surveys.

21323 (TKK-S/SLV–15) **Measurement methods for electric power systems.** Toivonen, L. World Energy Conference, Helsinki (Finland). Finnish National Committee. 1994. 63p. Order Number DE95779248. Source: OSTI; NTIS.

A wide area evaluation of the electric parameters of both the power network as well as of the electricity favours portable instrumentation for long-term field measurements. It is shown that an approach where signals are asynchronously sampled at a fixed rate and subsequently digitally processed, results in a versatile, uncomplicated construction of the instrument and in high accuracy. Besides the simplicity of implementation, asynchronously sampling is justified by the fact that the voltages and currents of the power system are not periodic in a strict sense since they contain stochastic components. The multirate processing in voltage, current and power measurement, and a uniform DFT analysis filter bank in spectrum analysis give high computational efficiency and well-defined pass and stop bands, and enable strict control of aliasing error. Data reduction and compression of the results cut down the memory demand and, thus, make it practical to construct a robust data storage using semiconductor memory chips. Due to speed and linearity constraints, some specific analogue processing circuitry is still necessary in the measurement of voltage impulses and a small dc component of an ac voltage, in order to achieve a

simple construction of hardware. Moreover, some specific design solutions such as a stable, differential input current shunt amplifier, and a dedicated floating point analogue-to-digital converter give high technical performance and lead to a straightforward realization in this application. (orig.)

2403 Power Transmission Lines and Cables

21324 (PNL–10561) **Transmission line capital costs.** Hughes, K.R.; Brown, D.R. Pacific Northwest Lab., Richland, WA (United States). May 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012233. Source: OSTI; NTIS; INIS; GPO Dep.

The displacement or deferral of conventional AC transmission line installation is a key benefit associated with several technologies being developed with the support of the U.S. Department of Energy's Office of Energy Management (OEM). Previous benefits assessments conducted within OEM have been based on significantly different assumptions for the average cost per mile of AC transmission line. In response to this uncertainty, an investigation of transmission line capital cost data was initiated. The objective of this study was to develop a database for preparing preliminary estimates of transmission line costs. An extensive search of potential data sources identified databases maintained by the Bonneville Power Administration (BPA) and the Western Area Power Administration (WAPA) as superior sources of transmission line cost data. The BPA and WAPA data were adjusted to a common basis and combined together. The composite database covers voltage levels from 13.8 to 765 W, with cost estimates for a given voltage level varying depending on conductor size, tower material type, tower frame type, and number of circuits. Reported transmission line costs vary significantly, even for a given voltage level. This can usually be explained by variation in the design factors noted above and variation in environmental and land (right-of-way) costs, which are extremely site-specific. Cost estimates prepared from the composite database were compared to cost data collected by the Federal Energy Regulatory Commission (FERC) for investor-owned utilities from across the United States. The comparison was hampered because the only design specifications included with the FERC data were voltage level and line length. Working within this limitation, the FERC data were not found to differ significantly from the composite database. Therefore, the composite database was judged to be a reasonable proxy for estimating national average costs.

2405 Environmental Aspects

21325 (INIS-BR–3526) **Environmental impact of high voltage aerial transmission lines.** Silva, R.P. (CAEEB, Brasilia, DF (Brazil)); Mouallen, M.C.; Quintella, S.E.A. Companhia Paranaense de Energia (COPEL), Curitiba, PR (Brazil). 1989. 6p. (In Portuguese). (CONF-8910591–: 10. national seminar on production and transmission of electric power, Curitiba (Brazil), 1-5 Oct 1989). Order Number DE95633449. Source: OSTI; NTIS (US Sales Only); INIS.

The identification of environmental impacts caused by the aerial transmission lines and the measures for reducing these impacts are discussed, considering the impact over the soil in different areas, biological effects caused by delayed exposure and visual impacts due to the line structures. A methodology for the impact evaluation and the aspects of the Environmental Impact Studies and Environmental Impact Report are also studied. (C.G.C.). 2 refs, 1 fig.

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 21324

25 ENERGY STORAGE

Refer also to citation(s) 21393

2505 Flywheels

21326 (ANL/ET/CP–85212) **A permanent-magnet rotor for a high-temperature superconducting bearing.** Mulcahy, T.M. (Argonne National Lab., IL (United States)); Hull, J.R.; Uherka, K.L.; Abboud, R.G.; Wise, J.H.; Carnegie, D.W. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950691–1: 14. international conference on magnet technology, Tampere (Finland), 11-16 Jun 1995). Order Number DE95014230. Source: OSTI; NTIS; GPO Dep.

Design, fabrication, and performance, of a 1/3-m dia., 10-kg flywheel rotor with only one bearing is discussed. To achieve low-loss energy storage, the rotor's segmented-ring permanent-magnet (PM) is optimized for levitation and circumferential homogeneity. The magnet's carbon composite bands enable practical energy storage.

2506 Thermal

21327 (DTU-LV–95-08) **Investigation of the lid construction for hot water pond storage.** Duer, K. Danmarks Tekniske Univ., Lyngby (Denmark). Lab. for Varmeisolering. May 1995. 15p. (In Danish). Contract ENS-51181-94.0006. Order Number DE95779209. Source: OSTI; NTIS.

A floating lid covering the pond heat storage facility at the Ottrupgaard Solar Heating Plant has been tested in a period of 35 days. A 1.5 x 1.5 m section of the lid has been lowered into the experimental water tank, where the temperature was constant at 95 deg.C. After the 35 days test the lid section was weighed, dismounted and checked for traces of water penetration. The lid was waterproofed by means of silicone and polyurethane joints on its surfaces. At the post-testing inspection the vertical edge profiles consisting of stainless steel were found to slightly corroded and the corner construction untight. Corner joints in the future lid at the Ottrupgaard heat storage facility, according to the results of testing, should be reinforced by stainless steel. The elements used for lid construction should be sealed. Polyurethane should be injected in-situ in order to avoid water influx, however there may occur problems with keeping the top plate quite flat (EG)

2509 Batteries

Refer also to citation(s) 21379

21328 (ANL/CMT/CP–84744) **Sulfide ceramics in molten-salt electrolyte batteries.** Kaun, T.D.; Hash, M.C.; Simon, D.R. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States);Illinois State Government, Springfield, IL (United States). DOE Contract W-31109-ENG-38. (CONF-950401–8: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013443. Source: OSTI; NTIS; GPO Dep.

Sulfide ceramics are finding application in the manufacture of advanced batteries with molten salt electrolyte. Use of these ceramics as a peripheral seal component has permitted development of bipolar Li/FeS_2 batteries. This bipolar battery has a molten lithium halide electrolyte and operates at 400 to 450C. Initial development and physical properties evaluations indicate the ability to form metal/ceramic bonded seal (13-cm ID) components for use in high-temperature corrosive environments. These sealants are generally $CaAl_2S_4$-based ceramics. Structural ceramics (composites with oxide or nitride fillers), highly wetting sealant formulations, and protective coatings are also being developed. Sulfide ceramics show great promise because of their relatively low melting point, high-temperature viscous flow, chemical stability, high-strength bonding, and tailored coefficients of thermal expansion. Our methodology of generating laminated metal/ceramic pellets (e.g., molybdenum/sulfide ceramic/molybdenum) with which to optimize materials formulation and seal processing is described.

21329 (ANL/CMT/CP–85522) **Materials issues in USABC-sponsored battery technologies.** Smaga, J.A. Argonne National Lab., IL (United States). 18 Jan 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38.

(CONF-950195–1: Capital metals and materials forum on electric vehicle battery technology prospects for materials and commercialization, Washington, DC (United States), 18 Jan 1995). Order Number DE95013393. Source: OSTI; NTIS; GPO Dep.

Battery goals for electric vehicles are doubled range and acceleration, performance, life, and total cost comparable to internal-combustion cars. Sponsored battery technologies face both technical and materials challenges to meet these goals. The materials issues for both the mid-term and long-term batteries are the focus of this paper. The expected demand for battery materials in the future is estimated.

21330 (CONF-941063–13) **Cathode limited charge transport and performance of thin-film rechargeable lithium batteries.** Bates, J.B.; Hart, F.X.; Lubben, D.; Kwak, B.S.; van Zomeren, A. Oak Ridge National Lab., TN (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 186. meeting of the Electrochemical Society; Miami, FL (United States); 9-14 Oct 1994. Order Number DE95008977. Source: OSTI; NTIS; GPO Dep.

Several types of thin-film rechargeable batteries based on lithium metal anodes and amorphous V_2O_5 (aV_2O_5), $LiMn_2O_4$, and $LiCoO_2$ cathodes have been investigated in this laboratory. In all cases, the current density of these cells is limited by lithium ion transport in the cathodes. This paper, discusses sources of this impedance in Li-aV_2O_5 and Li-$LiMn_2O_4$ thin-film cells and their effect on cell performance.

21331 (CONF-9410309–4) **Thin-film rechargeable lithium batteries.** Dudney, N.J.; Bates, J.B.; Lubben, D. Oak Ridge National Lab., TN (United States). Nov 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Contractor's coordination meeting; Dearborn, MI (United States); 24-27 Oct 1994. Order Number DE95008975. Source: OSTI; NTIS; GPO Dep.

Small thin-film rechargeable cells have been fabricated with a lithium phosphorus oxyniuide electrolyte, Li metal anode, and $Li_{1-x}Mn_2O_4$ as the cathode film. The cathode films were fabricated by several different techniques resulting in both crystalline and amorphous films. These were compared by observing the cell discharge behavior. Estimates have been made for the scale-up of such a thin-film battery to meet the specifications for the electric vehicle application. The specific energy, energy density, and cycle life are expected to meet the USABC mid-term criteria. However, the areas of the thin-films needed to fabricate such a cell are very large. The required areas could be greatly reduced by operating the battery at temperatures near 100°C or by enhancing the lithium ion transport rate in the cathode material.

21332 (LBL–35809) **Polymeric electrolytes for ambient temperature lithium batteries. Final report.** Farrington, G.C. (Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Materials Science and Engineering). Lawrence Berkeley Lab., CA (United States). Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012756. Source: OSTI; NTIS; GPO Dep.

Samples of a plasticized Li^+ polymer electrolyte having high conductivity at room temperature were prepared with mixed plasticizer compositions of ethylene carbonate (EC) and propylene carbonate (PC). The influence of EC:PC in varying proportions with 1M $LiAsF_6$ as the dissolved salt on the chemical and electrochemical properties of the electrolyte was studied. Electrolytes with mixed EC:PC compositions were found to have greater thermal stability, improved lithium and cathode (V_6O_{13}) interfacial properties, and superior mechanical properties compared to those prepared with pure EC and PC. The results of this work are relevant to possible uses of such electrolytes in energy storage technologies.

21333 (LBL–37071) **Electrochemical characterization of orthorhomobic Na_xMnO_2 for alkali metal polymer batteries.** Doeff, M.M.; Ding, Lie; DeJonghe, L.C. Lawrence Berkeley Lab., CA (United States). Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950412–11: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95012369. Source: OSTI; NTIS; GPO Dep.

Electrochemical potential spectroscopy (ECPS) has been used successfully to observe and explain ordering transitions in orthorhombic Na_xMnO_2 as it is discharged in a sodium/polymer cell. Features can be assigned on the basis of sequential filling of sites in the small and then the large tunnels of the structure as the reduction progresses. Intercalation of lithium into Na_xMnO_2 may be less straightforward than that of sodium, and is worthy of investigation by ECPS. Li/Na_xMnO_2 cells have a greater discharge capacity than Na/Na_xMnO_2 cells, suggesting that more than four lithiums per large tunnel can be inserted. (It is also possible, but less likely that more than one lithium can be placed inside the small tunnels). This implies that the sites for lithium occupancy might be somewhat different than that for sodium. Further investigation into the properties of orthorhombic Na_xMnO_2 and its utility as a positive electrode for rechargeable sodium and lithium cells is presently underway in this laboratory.

21334 (NREL/TP–473-7783) **Thermal management of batteries using a Variable-Conductance Insulation (VCI) enclosure.** Burch, S.D.; Parish, R.C.; Keyser, M.A. National Renewable Energy Lab., Golden, CO (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States);United States Advanced Battery Consortium (United States). DOE Contract AC36-83CH10093. (CONF-950729–5: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95009207. Source: OSTI; NTIS; GPO Dep.

Proper thermal management is important for optimum performance and durability of most electric-vehicle batteries. For high-temperature cells such as sodium/sulphur, a very efficient and responsive thermal control system is essential. Heat must be removed during exothermic periods and retained when the batteries are not in use. Current thermal management approaches rely on passive insulation enclosures with active cooling loops that penetrate the enclosure. This paper presents the design, analysis, and testing of an enclosure with variable conductance insulation (VCI). VCI uses a hydride with an integral electric resistance heater to expel and retrieve a small amount of hydrogen gas into a vacuum space. By controlling the amount of hydrogen gas, the thermal conductance can be varied by more than 100:1, enabling the cooling loop (cold plate) to be mounted on the enclosure exterior. By not penetrating the battery enclosure, the cooling system is simpler and more reliable. Also, heat can be retained more effectively when desired. For high temperatures, radiation shields within the vacuum space are required. Ceramic spacers are used to maintain separation of the steel enclosure materials against atmospheric loading. Ceramic-to-ceramic thermal contact resistance within the spacer assembly minimizes thermal conductance. Two full-scale (0.8-m x 0.9-m x 0.3-m) prototypes were designed, built, and tested under high-temperature 200°-350°C battery conditions. With an internal temperature of 330°C (and 20°C ambient), the measured total-enclosure minimum heat loss was 80 watts (excluding wire pass-through losses). The maximum heat rejection was 4100 watts. The insulation can be switched from minimum to maximum conductance (hydrogen pressure from 2.0×10^{-3} to 8 torr) in 3 minutes. Switching from maximum to minimum conductance was longer (16 minutes), but still satisfactory because of the large thermal mass of the battery.

21335 (SAND–95-0671) **Design rules and reality check for carbon-based ultracapacitors.** Eisenmann, E.T. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010575. Source: OSTI; NTIS; GPO Dep.

Design criteria for carbon-based Ultracapacitors have been determined for specified energy and power requirements, using the geometry of the components and such material properties as density, porosity and conductivity as parameters, while also considering chemical compatibility. This analysis shows that the weights of active and inactive components of the capacitor structure must be carefully balanced for maximum energy and power density. When applied to nonaqueous electrolytes, the design rules for a 5 Wh/kg device call for porous carbon with a specific capacitance of about 30 F/cm^3. This performance is not achievable with pure, electrostatic double layer capacitance. Double layer capacitance is only 5

to 30% of that observed in aqueous electrolyte. Tests also showed that nonaqeous elcctrolytes have a diminished capability to access micropores in activated carbon, in one case yielding a capacitance of less than 1 F/cm^3 for carbon that had 100 F/cm^3 in aqueous electrolyte. With negative results on nonaqueous electrolytes dominating the present study, the obvious conclusion is to concentrate on aqueous systems. Only aqueous double layer capacitors offer adequate electrostatic charging characteristics which is the basis for high power performance. There arc many opportunities for further advancing aqueous double layer capacitors, one being the use of highly activated carbon films, as opposed to powders, fibers and foams. While the manufacture of carbon films is still costly, and while the energy and power density of the resulting devices may not meet the optimistic goals that have been proposed, this technology could produce true double layer capacitors with significantly improved performance and large commercial potential.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 22900

21336 (ETDE-DE–126) **Chances and risks for the future world energy supply. Corporate initiatives facing governmental regimentation.** Rheinisch-Westfaelisches Elektrizitaetswerk AG, Essen (Germany). Energiewirtschaftlicher Arbeitskreis. May 1993. 43p. (In German). Order Number DE95780191. Source: OSTI; NTIS (US Sales Only).

Sufficient energy supply is indispensable for global development. It must be embedded in a precautionary policy for the protection of the world climate. All available energy sources must be drawn on and the technologies devised for their utilisation improved if the global energy demand is to be satisfied. For just this reason it is ecologically and economically unjustified to put a ban on certain fossil fuels or on nuclear energy in the industrialised countries. All CO_2-free energy sources, notably nuclear energy and renewable energies, will in the long run have to make a considerably larger contribution to the world energy supply than they have until now. The paper describes the energy-economical prospects for a future in which energy supply does not preclude environment consideration and resources preservation. (orig./UA)

2901 Energy Analysis and Modeling

21337 (ETDE/JP-mf–95787263) **Energy economics statistics, 1994 (domestic statistics).** Institute of Energy Economics, Tokyo (Japan). 10 Feb 1995. 77p. (In Japanese). Order Number DE95787263. Source: OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo, Japan.

Institute of Energy Economics, Japan has issued the 1994 energy economic statistical data, covering the domestic energy basic data in the 1989-1993 period. These data are divided into 7 categories, general energy, oil, coal, gas, LPG, LNG and electric power. The price data cover the average CIF's of individual imported energy sources, oil product prices, unit prices of power supplied by public utilities, trends of consumer price indexes by individual energy sources, and trends of relative prices of energy sources for residential purposes (Tokyo). The economic, industrial and other statistics cover the major economic indexes, trends of investments by energy industries (oil, gas and power), trends of production and consumption of major energy consumers (steel, aluminum, paper/pulp, ceramics, soil/stone, and naphtha-consuming chemical industries). The business/residential data cover trends of energy consumption for business and residential purposes, and the transportation data cover the trends of number of cars, number of passengers by transportation sectors, cargo quantities, and energy consumption by transportation sectors.

2902 Economics and Sociology

Refer also to citation(s) 20653, 21337, 21356, 21357, 21358, 21359, 21368, 21370, 21371, 21372, 21373, 21380, 21499

21338 (CRIE-Y–94002) **Survey of the basic literature on energy economics.** Murota, Y. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Yamamoto, H.; Nagata, Y.; Matsukawa, I.; Nagano, K.; Watanabe, N.; Suzuki, T.; Hondo, Y.; Iwano, Y.; Sugiyama, H.; Yamaji, K. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jul 1994. 121p. (In Japanese). Order Number DE95787251. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

The literature on energy economics is classified into demand, supply, and macro economics, and significance and characteristics of the analysis are described. The energy demand analysis is conducted mainly on effects of income and price. Effects of income are analyzed with GDP flexibility as indices, and GDP flexibility of developing countries is to approach gradually to 1 on the long term basis. However, there remains a question because there is a possibility of energy substituting for capital and labor. As to energy supply and demand, determination of the oil price is important, and the hotelling rule is a pioneer achievement in theoretical researches. The rule points out that the price gradually increases on a long term basis, according to reduction in reserve. With the oil crisis as a turning point, a discussion has become vigorous on effects of energy price on macro economics, and a large scale model analysis is carried out which handles correlation of energy economics. Further, using this model, an analysis is made on an effect of surcharge imposed as CO2 control measures. 121 refs., 27 figs., 23 tabs.

21339 (DOE/CE/90043–T2) **DOE/Project SEED student scholars partnership. Final report, June 7, 1994–April 27, 1995.** American Chemical Society, Washington, DC (United States). 13 Jun 1995. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-90CE90043. Order Number DE95013823. Source: OSTI; NTIS; GPO Dep.

Project SEED is an innovative career development activity administered by ACS for economically disadvantaged high school students. SEED students spend 10 weeks during the summer in an academic, industrial, or governmental research laboratory working under the supervision of a researcher. Intent is to attempt to overcome obstacles which have excluded the economically disadvantaged from professional careers. Students are required to prepare a technical summary, give presentations to their sponsoring groups, and design and display a poster session. Each student also completed a pre- and post-program survey.

21340 (DOE/ER/75993–1) **1994 New England Regional Science Bowl [held at] Massachusetts Institute of Technology, February 26, 1994.** USDOE, Washington, DC (United States); Massachusetts Inst. of Tech., Cambridge, MA (United States). [1994]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER75993. (CONF-9402146–Summ.: 1994 New England Regional science bowl, Cambridge, MA (United States), 26 Feb 1994). Order Number DE95011581. Source: OSTI; NTIS; GPO Dep.

This report deals with the 1994 New England Regional Science Bowl, being held at the Massachusetts Institute of Technology.

21341 (LBL-PUB–3274-Rev.(1995)) **Lawrence Berkeley Laboratory Affirmative Action Program. Revised.** Lawrence Berkeley Lab., CA (United States). [1995]. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012378. Source: OSTI; NTIS; GPO Dep.

The Lawrence Berkeley Laboratory's Affirmative Action Program (AAP) serves as a working document that describes current policies, practices, and results in the area of affirmative action. It represents the Laboratory's framework for an affirmative approach to increasing the representation of people of color and women in segments of our work force where they have been underrepresented and taking action to increase the employment of persons with disabilities and special disabled and Vietnam era veterans. The AAP describes the hierarchy of responsibility for Laboratory affirmative action, the mechanisms that exist for full Laboratory participation in the AAP, the policies and procedures governing recruitment at all levels, the Laboratory's plan for monitoring, reporting, and evaluating affirmative action progress, and a description of special affirmative action programs and plans the Laboratory has

used and will use in its efforts to increase the representation and retention of groups historically underrepresented in our work force.

21342 (NEI-DK–2009) **Energy and environment in Argentina. Past and prospective evolution.** Working Paper, 1. Hasson, G.D. de; Suarez, C.E.; Pistonesi, H. United Nations Environment Programme, Roskilde (Denmark). Collaborating Centre on Energy and Environment. Apr 1995. 179p. Order Number DE95779216. Source: OSTI; NTIS.

Future perspectives for Argentina's energy system and its main environmental impacts are discussed with special emphasis on the impact on air emission. The aim is to focus on the probable environmental consequences of deep changes in the organization and regulation of the country's energy systems. The Argentinian government has launched a process of economical reconstruction and committed itself to privatization of all activities previously in the hands of public agencies. The development of the energy system during the last twenty years is analysed in addition to the energy trajectory and its main environmental impacts, and policies applied during that period are discussed. Future energy development and its consequent environmental impacts will be strongly influenced by the domestic and international economic context and by the strategies of the new energy operators. A pessimistic scenario, based on the assumption of an unfavourable economic development, and an optimistic scenario, are analysed and compared. It is concluded that policies aimed at moderating air emission from the energy system should consider both the opportunities of incorporating new technologies in end-use energy consumption and the strategies adopted for energy supply. The lack of definite policies regarding supply may offset efforts made at end-use energy consumption level. International reform proposals stress the need to decrease State intervention and allow the free interaction of private investors within the framework of competitive and deregulated energy markets. Energy restructuring proposals seem to contradict the concern for environmental protection. (AB) (31 refs.)

21343 (NEI-DK–2027, pp. 252) **PETRA. A model of personal transport in Denmark.** Hvashoej Joergensen, C. (COWIconsult (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). Contract ENS-1753/94-0006. (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS; INIS.

Short communication AUTOMOBILES; ECONOMIC POLICY; P CODES; TRANSPORT; AUTOMOBILES; COMPUTERIZED SIMULATION; FUEL CONSUMPTION; AIR POLLUTION; DENMARK

21344 (NEI-DK–2027, pp. 363-373) **Empirical investigation of economic conditions effect upon freight transport and its distribution into various transport-means.** Jensen, T.C. (AKF (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS; INIS.

The purpose of this project is to elucidate whether freight transport can be organized more efficiently by changing shifting transportation means. Effect of changes in pricing of different transport forms is investigated. Sensitivity to transportation prices depends on supply and demand by the Danish industry and business. (EG)

21345 (SAND–94-2686) **Historical and projected costs of natural disasters.** Engi, D. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013875. Source: OSTI; NTIS; GPO Dep.

Natural disasters cause billions of dollars of damage and thousands Of deaths globally each year. While the magnitude is clear, the exact costs (in damage and fatalities) are difficult to clearly identify. This document reports on the results of a survey of data on the costs associated with significant natural disasters. There is an impressive amount of work and effort going into natural disaster research, mitigation, and relief. However, despite this effort, there are surprisingly few consistent and reliable data available regarding the effects of natural disasters. Even lacking consistent and complete data, it is clear that the damage and fatalities from natural disasters are increasing, both in the United States, and globally. Projections using the available data suggest that, in the United States alone, the costs of natural disasters between 1995 and 2010 will be in the range of $90 billion (94$) and 5000 lives.

2903 Environment, Health, and Safety

Refer also to citation(s) 20657, 20834, 20973, 20975, 20976, 20994, 21002, 21005, 21016, 21017, 21033, 21048, 21140, 21144, 21169, 21342, 21405, 21411, 21556, 22152, 22160, 22275, 22363

21346 (ANL/EA/CP–85912) **US Air Force Materiel Command's second round ECAMP results.** Levenson, J.B. (Argonne National Lab., IL (United States)); Horstman, P.; Weaver, M.A. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950451–3: 21. national environmental symposium and exhibition, San Diego, CA (United States), 17-21 Apr 1995). Order Number DE95012921. Source: OSTI; NTIS; GPO Dep.

The United States Air Force's Environmental Compliance Assessment and Management Program (ECAMP) is a process to improve Air Force environmental compliance, management, and programmatic support. Midway into the third round of Command-initiated (external) ECAMP evaluations for its fourteen Air Logistics and Systems Centers, the Air Force Material Command (AFMC) is continuing to identify the root causes of instances of environmental noncompliance. The AFMC initiated an analysis of all negative findings identified during the second round of external ECAMP evaluations (June 1991 to January 1993). Presented here is a summary of the analysis with emphasis on trends and root causes.

21347 (ANL/EA/CP–86430) **Analysis of industrial pollution prevention programs in selected Asian countries.** Chiu, S.Y. (Argonne National Lab., IL (United States). Environmental Assessment Div.). Argonne National Lab., IL (United States). [1995]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505208–1: Pacific basin conference on hazardous waste, Alberta (Canada), 7-12 May 1995). Order Number DE95011847. Source: OSTI; NTIS; GPO Dep.

Industrialization in developing countries is causing increasing environmental damage. Pollution prevention (P2) is an emerging environmental concept that could help developing countries achieve leapfrog goals, bypassing old and pollutive technologies and minimizing traditional control practices. The current P2 promotion activities in Hong Kong, the Republic of Korea, the Philippines, Singapore, Taiwan, and Thailand are discussed. These programs, generally initiated in the last 5 years, are classified into five categories: awareness promotion, education and training, information transfer, technical assistance, and financial incentives. All important at the early stages of P2 promotion, these programs should inform industries of the benefits of P2 and help them identify applicable P2 measures. Participation in these programs is voluntary. The limited data indicate that adoption of P2 measures in these countries is not yet widespread. Recommendations for expanding P2 promotion activities include (1) strengthening the design and enforcement of environmental regulations; (2) providing P2 training and education to government workers, nongovernmental organizations and labor unions officials, university faculties, and news media; (3) tracking the progress of P2 programs; (4) implementing selected P2 mandatory measures; (5) identifying cleaner production technologies for use in new facilities; (6) implementing special programs for small and medium enterprises; and (7) expanding P2 promotion to other sectors, such as agriculture and transportation, and encouraging green design and green consumerism.

21348 (CEA-CONF–11970) **Nuclear energy in France: assessing its impacts on the economy and the environment.** Charmant, A.; Devezeaux de Lavergne, J.G.; Ladoux, N.; Vielle, M. CEA, 75 - Paris (France). 1994. 14p. (CONF-940631–: 34. annual conference of the Canadian Nuclear Association; 15. annual conference of the Canadian Nuclear Society, Montreal (Canada), 5-8

Jun 1994). Order Number DE95631167. Source: OSTI; NTIS (US Sales Only); INIS.

As environmental matters become the focus of increasing concern, the implementation of major nuclear power programme has allowed France to enjoy the benefits of a comfortable position. Emissions of carbon dioxide per head in France are among the lowest in the industrialized world. On a worldwide level, Atomic Energy Commission forecasts have shown that the impact of the resumption of nuclear power programmes on the greenhouse effect would be limited. Nuclear power might have a useful role to play in the achievement of a more realistic reduction of these emissions.

21349 (CONF-950646–20) **Development of a comprehensive environmental technologies list for the U.S. Department of Energy.** Lombardi, D.A. (Oak Ridge National Lab., TN (United States)); Di Massa, F.V. Oak Ridge National Lab., TN (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Air and Waste Management Association meeting; San Antonio, TX (United States); 18-23 Jun 1995. Order Number DE95013214. Source: OSTI; NTIS; GPO Dep.

With lessons learned through the initial assessment of energy technologies and with a new vision outlined in DOE's new strategic plan, the Office of Policy determined that assessment of R&D activities should extend beyond energy technologies and consider all DOE technology R&D programs, including environmental and dual-benefit defense programs. Of particular importance is the consideration of how well environmental technology R&D activities support the paradigm shift toward sustainable development. Sustainable development, defined in the Clinton Administration's Report titled Technology for a Sustainable Future as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," is dependent on effective environmental technologies. The importance of environmental technologies is echoed in DOE's Strategic Plan in which one specific goal is stated as: "By the Year 2005, [DOE will] be a leading Federal Agency in environmental technology development focused on the Nation's needs."

21350 (DMI-SR–94-5) **The contribution of the Danish Meteorological Institute (DMI) to the EPOCH project 'The climate of the 21. century'.** Hesselbjerg Christensen, J.; Kaas, E.; Laursen, L. Danish Meteorological Inst., Copenhagen (Denmark). 1994. 72p. Order Number DE95779207. Source: OSTI; NTIS.

The main task of the Climate of the 21st Century project was formulated as an application of well established groups, running verified Atmospheric and Ocean General Circulation Models (A-GCMs and O-GCMs) to investigate anthropogenic climate change and natural climate variability. The sup-projects in the category jointed by the Danish Meteorological Institute (DMI) were: Short term climate variability, AGCM equilibrium climate response simulations and parameterizations, model intercomparison and validation and regional climate simulations with nested models. The latter aims at matching more detailed simulations of climate in regions such as Europe by utilizing techniques known from numerical weather forecasting over a limited domain. It was demonstrated that the models at DMI have some deficits in simulating the natural variability of the present climate in terms of blocking frequency and representation of persistent anomalies. It was found that the release version of Arpege, as used at DMI, does not seem to have been an improvement. It was demonstrated that the actual origin of an external climate forcing mechanism may have very similar consequences, in terms of (e.g.) pattern of temperature change, it being a doubling of CO_2 or a 1-2% increase in the solar constant. Results on climatic impact of stratospheric ozone depletion were inconclusive, except in revealing the need for a more up-to-date climate model at DMI. The main conclusion of the feasibility study is that it seems a realistic approach to adopt the nesting technique for the downscaling of GCM simulations. (AB) (33 refs.)

21351 (DOE/EH–0484) **Reference manual for toxicity and exposure assessment and risk characterization. CERCLA Baseline Risk Assessment.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Mar 1995. 170p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS; Center for Environmental Management Information, 1-800-736-3282.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 1980) (CERCLA or Superfund) was enacted to provide a program for identifying and responding to releases of hazardous substances into the environment. The Superfund Amendments and Reauthorization Act (SARA, 1986) was enacted to strengthen CERCLA by requiring that site clean-ups be permanent, and that they use treatments that significantly reduce the volume, toxicity, or mobility of hazardous pollutants. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1985; USEPA, 1990) implements the CERCLA statute, presenting a process for (1) identifying and prioritizing sites requiring remediation and (2) assessing the extent of remedial action required at each site. The process includes performing two studies: a Remedial Investigation (RI) to evaluate the nature, extent, and expected consequences of site contamination, and a Feasibility Study (FS) to select an appropriate remedial alternative adequate to reduce such risks to acceptable levels. An integral part of the RI is the evaluation of human health risks posed by hazardous substance releases. This risk evaluation serves a number of purposes within the overall context of the RI/FS process, the most essential of which is to provide an understanding of "baseline" risks posed by a given site. Baseline risks are those risks that would exist if no remediation or institutional controls are applied at a site. This document was written to (1) guide risk assessors through the process of interpreting EPA BRA policy and (2) help risk assessors to discuss EPA policy with regulators, decision makers, and stakeholders as it relates to conditions at a particular DOE site.

21352 (DOE/EIS–0215-ROD) **Record of Decision: Pinon Pine Power Project, Tracy Station, Nevada.** Wachter, J.K. USDOE Morgantown Energy Technology Center, WV (United States). Program Support Div. 8 Nov 1994. 39p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95009934. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (Department) has decided to provide approximately $135 million in cost-shared Federal funding as part of the Clean Coal Technology Demonstration Program for the design, construction, and operation of the Pinon Pine Power Project. It would demonstrate integrated gasification combined-cycle technology with hot gas clean-up at the Sierra Pacific Power Company's (Sierra Pacific) Tracy Power Station near Reno, Nevada. Following careful evaluation of the potential environmental impacts, consideration of Clean Coal Technology Demonstration Program goals and objectives, review and analysis of public comments, and consultation with Federal and state agencies and Indian tribal representatives, the Department issued the Final Environmental Impact Statement for the Pinon Power Project. The project is expected to generate sufficient data from design, construction, and operation, to allow private industry to further assess the potential for commercial application of this technology to new or existing generating facilities. No unacceptable adverse impacts are expected from the construction or operation of the Pinon Pine Power Project. This report describes potential environmental impacts and mitigation measures.

21353 (DOE/ID–10478-UGF) **A User's Guide to the SNF & INEL EIS.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). [1995]. 35p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012050. Source: OSTI; NTIS; INIS; GPO Dep.

This User's Guide is intended to help you find information in the SNF and INEL EIS (that's short for US Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement). The first section of this Guide gives you a brief overview of the SNF & INEL EIS., The second section is organized to help you find specific information in the Environmental Impact Statement – whether you're interested in a management alternative, a particular site (such as Hanford), or a discipline (such as land use or water quality).

21354 (DOE/NV/11432–171) **Untitled article pollution prevention advisor.** Schoppman, J.W. Reynolds Electrical and

Engineering Co., Inc., Las Vegas, NV (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-94NV11432. Order Number DE95011300. Source: OSTI; NTIS; GPO Dep.

Tests to characterize the material in drums containing crushed fluorescent lighting tubes at the Nevada Test Site were conducted and a determination was made that the drums contain no hazardous materials.

21355 (ETDE-DE--116) **Law on the avoidance of residues, utilization of raw materials, and disposal of wastes.** Zur Sache. Themen parlamentarischer Beratung, v. 6/94. Deutscher Bundestag, Bonn (Germany). Referat Oeffentlichkeitsarbeit. 1994. 1054p. (In German). Order Number DE95780042. Source: OSTI; NTIS (US Sales Only).

The present paper documents the legislative procedure for the law on Materials Recycling and Waste Management (KrW-/AbfG). The Mediation Committee's recommendation in favour of the law found the Bundestag's unanimous approval on 26 June 1994. The approval of the Bundesrat followed on 8 July 1994. The law was promulgated on 6 October 1994 and is to take effect two years after this date. The purpose of the law is to encourage materials recycling and so help conserve natural resources and secure the environmentally acceptable disposal of materials. Its regulations apply to the avoidance, utilisation, and disposal of wastes. (orig.)

21356 (GSF-39/93, pp. 364-373) **Strategies for an intelligent Protection of the Alps - Scientific information in politics.** Krott, M. (Inst. fuer Forstliche Betriebswirtschaft und Forstwirtschaftspolitik, Univ. fuer Bodenkultur, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Environmental protection in the alpine region is mostly based on a healthy mountain forest which protects roads, settlements and agricultural areas. Environmental policies are therefore aimed mostly at early diagnosis of now damage and increased ecological orientation of traditional forest utilisation such as forestry, hunting, forest pasturing and also tries to reduce the different kinds of emmissions which affect the forest ecosystem. Scientific findings can provide help for all these tasks provided politicians are able to use scientific findings in without modifying them. In practical terms this very rarely happens on the area of forest protection policies. This analysis shows some of the main information barriers and tries to establish forest information strategies in order to make topical scientific findings an integral part of forest protections. (orig./EW)

21357 (GSF-39/93, pp. 374-381) **The contribution of environmental protection- and forest protection laws on reduction of forest soil pollution in Switzerland.** Gottesmann, J. (ETH/OeVS, Einsiedeln (Switzerland)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The Federal Constitution of Switzerland says in paragraph 24, that the Federal Authorities reserve the right of supervision with a forest police force and para. 24 septies BV3 says that the Federal organs will issue regulation on the protection of man and his natural environement against harmful influences or nuisances. Based on this regulations a now Federal Act on environmental protection (USG) was issued in 1983 and a new Federal Act on forests (WAG) was issued in 1991. Both Acts were created after the effects of forest death had been recognised. (orig./EW)

21358 (GSF-39/93, pp. 382-393) **Ecosystem management and/or forest management.** Volz, K.R. (Lehrstuhl fuer Forstpolitik der Univ. Muenchen (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Deposition of pollutants pollute forest ecosystems just like most direct or indirect influences of humankind. Proper control is therefore necessary to attenuate or reduce their effects. Creating a proper forest ecosystem management schemes, however, encounters a great deal of obstacles as soon as this concept is defined as a holistic control instrument for all anthropogenically influence processes in a forest. One must also take into account that not all of the complex feedback mechanisms which influence storage, autoregulation and elasticity of the complex forest ecosystems are known today. If the ecosystem management is viewed predominantly as a reflection of the changing relationship between forest and society it may produce promising ideas for a concept of conflict-solving which combines the various demands of society with the demands of a forest ecosystem. (orig./EW)

21359 (GSF-39/93, pp. 394-405) **Research concepts on environmental precaution measures in the forest areas of Bavaria.** Holzapfl, R. (Bayerische Landesanstalt fuer Wald und Forstwirtschaft, Freising (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/research programs; ENVIRONMENTAL POLICY/forests; ENVIRONMENTAL POLICY/research programs; FORESTS; TERRESTRIAL ECOSYSTEMS; LEGAL ASPECTS; PUBLIC INFORMATION; FEDERAL REPUBLIC OF GERMANY

21360 (INIS-mf-15114) **Potentials for energy saving and CO_2 reduction in Baden-Wuerttemberg. Status report.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 1. Weimer, W.; Luenstroth, U. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Dec 1993. 84p. (In German). Order Number DE95785377. Source: OSTI; NTIS (US Sales Only); INIS.

In order to protect the climate the Administration of the state of Baden-Wuerttemberg aims at cutting energy-related CO_2-emissions by 30% by the year 2005. This study analyses the potentials of energy consumption and CO_2-reduction in the state of Baden-Wuerttemberg in the framework of an evaluation of literature. As special emphasis is put on technical steps such as an increase in efficiency with respect to the generation and consumption of energy as well as on the substitution of fossil energy sources by regenerative techniques of energy generation. In order to obtain considerable potentials of energy-saving a moderate increase in

energy prices as well as several actions to reduce impediments are required . However, an achievement of those goals by the year 2005 is only partly possible, because of the time required. The evaluation of literature serves as a preparation of the comprehensive project Klimavertraegliche Energieversorgung in Baden-Wuerttemberg (greenhouse-gas-reduced energy supply in Baden-Wuerttemberg) of the Center of Technology Assessment in Baden-Wuerttemberg. (orig.)

21361 (NEDO-GET–9310-2) **Promotion project to develop the global environment related industrial technology. Investigation on the possibility of research exchange.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 142p. (In Japanese). Order Number DE95786802. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

Through visits to US universities and research institutes, investigation was made on the trend of global environment-related research and possibility of their exchanging the result of research with the RITE (Research Institute of Innovative Technology for the Earth). To investigate the process technology to utilize microbes harmoniously with the environment, the visit was paid to Cornell University, Battelle Memorial Institute and Risk Reduction Engineering Laboratory, where the investigation was made on the environmental bioremediation with microbial functions and clean process production without by-producing substances to load the environment. To investigate the technical measures against the global warming, the visit was paid to Brookhaven National Laboratory, Massachusetts Institute of Technology, California University, Hawaii University and Pacific International Center for High Technology Research, where the investigation was made, through discussion and exchange of research information and opinion with researchers and engineers, on the possibility of their exchanging the result of research with the RITE. Judging from the investigation of this time, the research which is mutually complementary between Japan and USA is easy to promote, because their respective advanced fields do not overlap with each other. 88 refs., 11 figs., 6 tabs.

21362 (NEI-DK–2026, pp. 41) **Carbon dioxide emission from transportation.** Lundgren, K. (Luleaa University of Technology, Dept. of Environmental Planning and Design, Division of Traffic Engineering, Luleaa (Sweden)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (CONF-9408240–Vol.1: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 1.* 223p. Order Number DE95787784. Source: OSTI; NTIS; INIS.

Short communication CARBON DIOXIDE; EXHAUST GASES; AIR POLLUTION; AUTOMOBILES; DENMARK; COMBUSTION PRODUCTS

21363 (NEI-DK–2026, pp. 93) **Environmental requirements to tanker ships - effect on market and competition situation.** Pettersen Strandenes, S. (SIOeS, Norges Handelshoeyskole, Bergen-Sandviken (Norway)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Norwegian). (CONF-9408240–Vol.1: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 1.* 223p. Order Number DE95787784. Source: OSTI; NTIS.

Short communication TANKER SHIPS; ENVIRONMENTAL IMPACTS; COMPUTERIZED SIMULATION; COMPETITION; MARKET

21364 (NILU-F–4/94) **Unsolved international environmental problems and their influence in Norway.** Dovland, H. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. 10p. (In Norwegian). Order Number DE95779282. Source: OSTI; NTIS.

The publication deals with global pollution problems and their influence in Norway. The need of sustainable development to solve these problems is discussed. The attention is laid on the most threatening types of air pollutants in an European and global scale with the primary emphasis on acidification, photochemical oxidants, degradation of ozone layer, and possible climatic changes caused by the greenhouse effect. Causal relations to each of these problems together with the status of international cooperation and the possibilities of future solution, are briefly described.

21365 (NILU-F–9/94) **The case of transboundary air pollution.** Dovland, H. Norsk Inst. for Luftforskning, Kjeller (Norway). May 1994. 6p. (CONF-9404267–1: OECD workshop on trade and environment: PPMs issues, Helsinki (Finland), 6-7 Apr 1994). Order Number DE95779281. Source: OSTI; NTIS.

The publication deals with transboundary air pollution. Topics are: Critical loads approach; elements of the protocol on further reductions of sulphur emissions. To use the critical loads approach, the information to be needed is such as inventories of current emissions and projections of future emissions, estimates of potential for and costs of emission reductions, long-range transport models describing in quantitative terms the transport of air pollutants within regions, maps of critical loads, and integrated assessment models in which the above elements are combined to assess alternative reduction strategies. The long term goal given in the protocol is to ensure that sulphur deposition do not exceed critical loads. Examples are given. In Germany, the additional costs of sulphur abatement from electricity generation is 1.5 pfennig/kWh.

21366 (NILU-OR–17/94) **Long-range transported pollutants. Supplies, effects and critical loads.** Floeisand, I.; Johannessen, T. (eds.). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. 210p. (In Norwegian, English). (CONF-9403229–: Long-range transported pollutants. Supplies, effects and critical loads, Grimstad (Norway), 7-9 Mar 1994). Order Number DE95779285. Source: OSTI; NTIS.

The report consists of a collection of papers dealing with the effects and the critical load of air-borne pollutants in Norway. The papers from this meeting are based on the status of knowledge and the research requirement experienced from two Norwegian research programs covering the supplies and effects of long-range transported pollutants together with the critical load to nature. Seven themes are covered such as air, water chemistry, water biology, soil, forest, plants and animals. Three papers from the meeting are prepared. 312 refs., 76 figs., 26 tabs.

21367 (NILU-OR–21/94) **Short-time study of the connection between air pollution and health effects in Grenland. Effects of air pollution on the humans' understanding of their own health.** Clench-Aas, J. (Norsk Inst. for Luftforskning, Kjeller (Norway)); Bartonova, A.; Aarnes, M.J.; Bjerknes-Haugen, G.; Samuelsen, S.O.; Bakketeig, L.S.; Hjort, N.L.; Halvorsen, K. Norsk Inst. for Luftforskning, Kjeller (Norway); Statens Inst. for Folkehelse, Oslo (Norway). Apr 1994. 201p. (In Norwegian). Order Number DE95779279. Source: OSTI; NTIS.

The air in Grenland (an industrialized area in southern Norway) contains various pollutants such as sulfur dioxide, nitrogen dioxide, ozone, hydrocarbons and particles including acid aerosols. These originate from industry, traffic and domestic heating. The sources of emissions lie at the valley bottom. Air pollutants are also transported into the region from sources outside the area, e.g. due to long-range transport. Even though subjective symptom reporting does not necessarily indicate a major health effect, it should reflect a general state of well-being which is of importance to take into account in assessing the impact of air pollutants. Therefore, both symptom reporting and objective measurements of lung function were included in the investigation. The Grenland study began in the spring of 1987 and has been a cooperative project between the Norwegian Institute for Air Research and the National Institute of Public Health. The aim of the study was to investigate whether air pollutants either individually or in combination had short-term effects on health and well-being of people living in the Grenland area. 56 refs., 55 figs., 17 tabs.

21368 (NRRI–93-8, pp. 65-72) **Acid rain compliance: The need for regulatory guidance.** Solomon, B.D. (Environmental Protection Agency, Washington, DC (United States)). National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In

Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops. 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

This article presents a broad view of the need for regulatory guidance when confronting the problem of acid rain. The two major topics addressed are (1) Why is guidance needed and (2) What kind of guidance is needed. Discussion of rate and accounting treatment of allowances, acid rain compliance planning, and allowance trading and energy efficiency are included.

21369 (NRRI–93-8, pp. 75-90) **Analysis of utility acid rain compliance plans: A discussion of issues and methods.** Brick, S. (MSB Energy Associates, Inc., Middleton, WI (United States)). National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

Utility acid rain compliance plans have begun to roll into public utility commissions around the eastern half of the country. These plans typically represent the combined effort of utility staff and consultants, and have evolved since early drafts of Title IV of the Clean Air Act Amendments of 1990 (CAAA) began to circulate, several years back. The filings themselves often consist of many volumes of technical analysis, supporting documentation, and accompanying testimony. Hundreds of computer simulations are often presented and these, in turn, are underlain by hundreds of assumptions covering a staggering range of variables. Commissions usually have little time and few external resources with which to review and in some cases, preapprove proposed utility actions. There may be a tendency among commissions to forego a comprehensive review, approve utility plans as filed, and hope for the best. There are at least three important reasons, however, why this should not occur: (1) The magnitude of planned CAAA expenditures is large. (2) Preapproval, either formal or de facto, is becoming increasingly common. Although the approval of specific actions is certainly one outcome of the preapproval process, it should not be the sole or even principal outcome. The main focus of preapproval should involve defining an economic and institutional framework for how utilities, with input from regulators and the public, can best meet future customer needs. Done correctly, the preapproval process provides a meaningful, preexisting context which can be used to analyze outcomes. (3) Without adequate review market opportunities may be ignored and compliance costs increased unnecessarily. This article discusses the following topics in detail: CAAA Compliance Plan Review framework; Emission Reduction Alternatives: How Much is Enough?; Assumptions, Analytical Methods, and Evaluation Criteria of compliance plans; CAAA compliance costs and IRP. 2 figs., 3 tabs.

21370 (NRRI–93-8, pp. 91-114) **The role of integrated resource planning, environmental externalities, and anticipation of future regulation in compliance planning under the Clean Air Act Amendments of 1990.** Bernow, S. (Tellus Institute, Boston, MA (United States)); Biewald, B.; Wulfsberg, K. National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

Utilities are developing sulfur dioxide (SO_2) emission compliance plans to meet limitations of the Clean Air Act Amendments of 1990 (CAAA). Compliance plans will have long-term effects on resource selection, fuel choice, and system dispatch. Use of integrated resource planning (IRP) is necessary to ensure compliance plans are consistent with the overall societal goals. In particular, environmental externalities must be integrated with the compliance planning process. The focus of the CAAA is on air pollution reduction, specifically acid gases and toxics, and attainment of National Ambient Air Quality Standards (NAAQS) for criteria pollutants. Title IV specifically focuses on sulfur dioxide with a national allowance trading system, while further regulation of toxics and nitrogen oxides is slated for additional study. Yet, compliance planning based narrowly upon today's environmental regulations could fail to meet the broad goals of IRP if a larger array of environmental externalities is excluded from the analysis. Compliance planning must consider a broad range of environmental effects from energy production and use to (1) protect society's long-term stake in environmental quality, and (2) ensure that today's plans are rich enough to accommodate potential changes in regulation and national environmental goals. The explicit recognition of environmental effects, such as those associated with CO_2 release, will result in prudent compliance plans that take advantage of current opportunities for pollution avoidance and have long-term viability in the face of regulatory change. By including such considerations, the mix of resources acquired and operated (supply and demand, existing and new, conventional and renewable, fuel type and fuel quality, pollution control, and dispatch protocols) will be robust and truly least-cost.

21371 (NRRI–93-8, pp. 117-140) **Regulatory treatment of allowances and compliance costs.** Rose, K. (National Regulatory Research Institute, Columbus, OH (United States)). National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

The Clean Air Act Amendments of 1990 (CAAA) established a national emission allowance trading system, a market-based form of environmental regulation designed to reduce and limit sulfur dioxide emissions. However, the allowance trading system is being applied primarily to an economically regulated electric utility industry. The combining of the new form of environmental regulation and economic regulation of electric utilities has raised a number of questions including what the role should be of the federal and state utility regulating commissions and how those actions will affect the decision making process of the utilities and the allowance market. There are several dimensions to the regulatory problems that commissions face. Allowances and utility compliance expenditures have implications for least-cost/IPR (integrated resource planning), prudence review procedures, holding company and multistate utility regulation and ratemaking treatment. The focus of this paper is on the ratemaking treatment. The following topics are covered: ratemaking treatment of allowances and compliance costs; Traditional cost-recovery mechanisms; limitations to the traditional approach; traditional approach and the allowance trading market; market-based cost recovery mechanisms; methods of determining the benchmark; determining the split between ratepayers and the utility; other regulatory approaches; limitations of incentive mechanisms.

21372 (NRRI–93-8, pp. 141-149) **Utility regulators and the market for emission allowances.** Bohi, D.R. National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

When it comes to emission trading under the Clean Air Act, a major concern of most people in the electric utilities industry is the effect of this new form of environmental regulation on the industry and the way it is regulated. This paper focuses on a different concern: the effect of the industry and the way it is regulated on the emission trading program. Emission trading must prove to be successful in lowering the cost of reducing sulfur dioxide emissions if this approach to environmental regulation is to be regarded as a viable substitute for traditional command-and-control regulation. In

addition, whether or not utilities will buy and sell allowances as intended depends on the actions of the public utility regulators. This paper covers both setting the cost recovery rules and the incentive to sell and the capital gain.

21373 (NRRI–93-8, pp. 151-170) **Discussion paper on wholesale ratemaking considerations for sulfur dioxide emissions allowance trading.** Wessler, E. National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

The acid rain provisions of the Clean Air Act Amendments of 1990 (CAAA) created an allowance trading program for SO_2 emissions from electric utility power plants. Theoretically, the trading program will provide utilities the flexibility to control their SO_2 emissions at minimum aggregate societal costs. The trading program is a significant change from command-and-control environmental policies. A continuing concern is whether the market-oriented trading program is compatible with the pervasive rate regulation of the electric utility industry. Economists accept traditional rate regulation policies tend to provide incentives for utilities to minimize risks, rather than costs. To the extent that this is true, the allowance trading experiment is not likely to be successful. A number of commenters have described proposals for alternative regulatory policies to provide utilities with appropriate incentives for cost-minimization. These proposals focus on utility incentives at a "macro" level This paper has a "micro" level focus. It examines options for ratemaking that may also influence utility incentives for cost-minimization to provide a structured discussion of the different types of transactions that involve allowances. Emphasis is on the implications of allowance trading on ratemaking for wholesale power sales. Some of the same considerations that apply to wholesale ratemaking may also apply to retail ratemaking. Four generic types of allowance transactions are examined: Type 1: Unbundled Allowance Sales, Type 2: Wholesale Power Sales, Type 3: Pooling Arrangements, and Type 4: Holding Company Transactions. Each of these four generic allowance transactions is assessed along two 3 dimensions: jurisdictional issues and wholesale ratemaking considerations.

21374 (NRRI–93-8, pp. 173-186) **Allowance trading under the Clean Air Act: Who should regulate, and when?.** Lock, R. (LeBoeuf, Lamb, Leiby & MacRae, Washington, DC (United States)). National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

The goal of this paper is to explore how compliance with the Clean Air Act Amendments of 1990 (CAAA), especially Title IV and emission trading under it, will affect the current relationship between state and federal regulation. It is difficult, with the limited experience we have had under Title IV, to be definitive about or to be a very strong advocate of too many policy positions. What may be most helpful at this point is to identify where the difficult issues in state/federal relations might arise; and then to explore ways in which tensions might be either avoided or resolved. One anticipated conclusion is that a traditional regulatory mindset could be very destructive if applied to this new area of oversight without due sensitivity to what Congress is trying to achieve in Title IV. That concern pervaded the early legislative debates; and it persists today. Title IV presents some unique challenges to state regulators and will require some creative solutions and fresh thinking if the goals of Congress are to be realized and the full benefits that allowance trading can offer are to be reaped by electricity consumers. In the ultimate analysis, Title IV amounts to a massive internalization of the external costs imposed on society by acid rain deposition. (This places in serious question the notion of additional externality "adders" for sulfur dioxide (SO_2) and nitrous oxide (NO_x) at the state level for utility supply planning purposes.) The whole point of Title IV is to give those directly charged with compliance, namely power producers, the maximum flexibility to pursue least-cost compliance solutions. Perhaps the biggest single factor in how well they do this will be how state regulators respond to their compliance and allowance trading initiatives.

21375 (NRRI–93-8, pp. 187-216) **Acid rain compliance and coordination of state and federal utility regulation.** Nordhaus, R.R. (Van Ness, Feldman, and Curtis, P.C., Washington, DC (United States)). National Regulatory Research Inst., Columbus, OH (United States). Jul 1993. (CONF-9205161–Exc.: Regulatory policy issues and the clean air workshop; Regulatory policy issues and the clean air act workshop; International Energy Agency carbon dioxide disposal symposium, St. Louis, MO (United States); Charlotte, NC (United States); In *Regulatory policy issues and the Clean Air Act: Issues and papers from the state implementation workshops.* 217p. Order Number DE95008741. Source: OSTI; NTIS; GPO Dep.

The Clean Air Act Amendments of 1990 (CAAA) impose new controls on emissions by electric utilities of the two major precursors of acid rain: sulfur dioxide and oxides of nitrogen. Utilities, and the utility holding company systems and power pools of which they are members, will be subject to extensive and costly compliance obligations under the new stature. Most of these utilities, utility systems, and power pools are regulated by more than one utility regulatory authority. Utility regulators will need to coordinate their policies for ratemaking and for review of acid rain compliance strategies if least-cost solutions are to be implemented without imposing on rate payers and utility shareholders the costs and risks of inconsistent regulatory determinations. This article outlines the scope of the coordination problem and spells out possible approaches that utility regulators may take in dealing with it. Topics covered include the following: the 1990 Clean Air Act Amendments; acid rain (SO2); acid rain (NOx); costs of compliance; implications for utility regulation - federal and state utility regulatory framework; potential jurisdictional conflicts under existing state/federal utility regulatory scheme - single utility, holding companies, power pools; Utility regulatory issues under the 1990 amendments - planning conflicts, operational conflicts; methods for dealing with potential jurisdictional conflicts; coordination mechanisms - informal consultation, rulemaking,coordination of adjudicatory proceedings, FERC rate filings.

21376 (YMP-ESIT–42/1992) **East Europe Project: Co-operation for a better environment.** Ministry of the Environment, Helsinki (Finland). 1992. 4p. Order Number DE95779261. Source: OSTI; NTIS.

Published also in Finnish as Esite 45/1992 and in Swedish as Brochure 42/1992. Addiational information may be obtained from Ministry of the Environment, East Europe Project, P.O.Box 399, FIN-00121 Helsinki, Finland.

The East Europe Project, launched by the Finnish Ministry of the Environment in 1991 to protect the environment in neighbouring regions of Eastern Europe, is now fully under-way. The project has established itself as part of Finland's active, international environmental policy. Aiming at better air protection, protection of the Baltic Sea, and the development of hazardous waste management, using Finnish environmental know-how and technology The East Europe Project provides funds for joint projects which, when implemented, will bring significant cuts in airborne and waterborne pollution reaching Finland and the Baltic Sea. It will also improve hazardous waste management. Funds are granted to Finnish companies and corporations primarily promoting the use of Finnish environmental technology or testing new Finnish techniques or know-how.

2904 Energy Resources

Refer also to citation(s) 21370, 21413

21377 (DOE/EIA–0466(93)) **Profiles of foreign direct investment in U.S. energy 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 5 May 1995. 39p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012008. Source: OSTI; NTIS; GPO; GPO Dep.

Profiles of Foreign Direct Investment in US Energy 1993 describes the role of foreign ownership in US energy resources. This report also looks at the investment patterns of US energy companies in other countries. The data used in this report come from the Energy Information Administration (EIA), the US Department of Commerce, company annual reports, and public disclosures of investment activities.

21378 (NREL/TP–400-7830) **Using performance parameters, metrified performance objectives, and quality management assessments to improve the effectiveness of research organizations.** Bodnarczuk, M. National Renewable Energy Lab., Golden, CO (United States). Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-9509131–1: 22. annual National Energy and Environmental Division education and training symposium, Charlotte, NC (United States), 17-20 Sep 1995). Order Number DE95004087. Source: OSTI; NTIS; GPO Dep.

This paper begins by raising the issue of whether the theoretical model of customer-suppliers-products-services usefully describes the activities of laboratory life, using a case study from Fermilab. After describing scientific activities as work, not volunteerism, I present a model that has four performance parameters that can be used to evaluate DOE-funded research laboratories: (1) Do they have a well-defined management system? (2) Are they doing good science? (3) Are they managing their resources effectively? (4) Are they responsive to their customers? From these four parameters I describe how to metrify performance objectives, then use them to evaluate research organizations. I describe these performance objectives within the context of views I have published elsewhere, and according to Stephen R. Covey's metaphor of production/production capability (P/PC) balance in his book The 7 Habits of Highly Effective People.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 20567, 20597, 21045, 21075, 21076, 21118, 21172, 21329, 21340, 21503, 21756, 21846, 22119

21379 (ANL/CMT/PC–86657) **The Chemical Technology Division at Argonne National Laboratory: Applying chemical innovation to environmental problems.** Argonne National Lab., IL (United States). [1995]. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95013372. Source: OSTI; NTIS; INIS; GPO Dep.

The Chemical Technology Division is one of the largest technical divisions at Argonne National Laboratory, a leading center for research and development related to energy and environmental issues. Since its inception in 1948, the Division has pioneered in developing separations processes for the nuclear industry. The current scope of activities includes R&D on methods for disposing of radioactive and hazardous wastes and on energy conversion processes with improved efficiencies, lower costs, and reduced environmental impact. Many of the technologies developed by CMT can be applied to solve manufacturing as well as environmental problems of industry.

21380 (ANL/ER/CP–85412) **Performance specifications for technology development.** Erickson, M.D. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950209–9: 4. international symposium on field screening methods for hazardous wastes and toxic chemicals, Las Vegas, NV (United States), 22-24 Feb 1995). Order Number DE95012467. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of any instrument, technique, or method development project is to deliver needed and usable technologies to customers. To help the US Department of Energy's Office of Environmental Management and its investigators meet that goal, technology performance specifications are being developed for implementation in research and development and in documentation, testing, and evaluation projects. Technology performance specifications will be used to establish milestones, evaluate the status of ongoing projects, and determine the success of completed projects. Preliminary performance specifications will be required in proposals and will be highly weighted in the technical evaluation. The general performance specification approach is to document what currently exists or is nearing completion and compare that baseline to the customers' needs to identify the unmet requirements. These unmet requirements then form the basis for the technology development needs that OTD investigators must address. The process needs to be quantitative, where appropriate, to focus project goals away from vague generalities like "better" toward specifics "reduce detection limit from 50 μg/L to 100 ng/L", or from "cheaper" to "reduction of labor costs for step A from 4 hours to 0.5 hour."

21381 (ANL/ES/CP–86457) **Pulp and paper program fact sheets.** Argonne National Lab., IL (United States). [1995]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505127–Summ.: 1. industrial energy efficiency symposium and exposition, Washington, DC (United States), 1-3 May 1995). Order Number DE95013891. Source: OSTI; NTIS; GPO Dep.

Summaries are presented of Argonne technology transfer research projects in: sustainable forest management, environmental performance, energy performance, improved capital effectiveness, recycling, and sensors and controls. Applications in paper/pulp industry, other industries, etc. are covered.

21382 (DOE/CE/27504–T12) **Urban Consortium Energy Task Force applied research units and projects, 1992 program. Summary and abstracts.** Public Technology, Inc., Washington, DC (United States). Oct 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-90CE27504. Order Number DE95011358. Source: OSTI; NTIS; GPO Dep.

This report contains brief descriptions of projects involved in the urban Consortium Energy Task Force (UCETF). The Consortium is a special network which helps to define urban problems, and commercialize technologies which could help solve those problems. Research and Development priorities within the program are transportation, energy, environment, and economic development and energy efficient facilities. The Consortium has established partnerships with US DOE on energy utilities, alternative vehicle fuels, waste management, and electricity management. A technology transfer committee was established to build a marketing program.

21383 (DOE/EIA–0204(95/02)) **EIA new releases: EIA examines the growing importance of longwall mining.** USDOE Energy Information Administration, Washington, DC (United States). Office of the National Energy Information System. 17 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012303. Source: OSTI; NTIS; GPO Dep.

This publication disseminates information on progress in various DOE research areas. This issues contains information on Longwall mining; electric fleet utility survey; electronic publishing system; other publications of the EIA; and places from which to purchase publications.

21384 (DOE/ER/40882–1) **Texas Manufacturing Technology Center feasibility study for the Inland Regional Industrial Technology Institute.** Texas Mfg. Technology Center, Waco, TX (United States). 31 Oct 1994. 360p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-94ER40882. Order Number DE95010183. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the Texas Manufacturing Technology Center (TMTC) Business Plan to convert the Central Facility of the Superconducting Super Collider project to alternate uses. The plan is divided into six sections: (1) Executive Summary, (2) Market and Benefit Analysis, (3) Marketing Strategy, (4) Services, (5) Organization and Operations Overview, and (6) Financial Plan. Each area is supported by separate documents that address individual opportunities and challenges associated with transitioning the facility,

and its asset base to new uses for benefit of the locality, state, region and nation.

21385 (DOE/FE–0330) **Clean Coal Technology Demonstration Program. Program update 1994.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Apr 1995. 303p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012257. Source: OSTI; NTIS; GPO Dep.

The Clean Coal Technology Demonstration Program (CCT Program) is a $7.14 billion cost-shared industry/government technology development effort. The program is to demonstrate a new generation of advanced coal-based technologies, with the most promising technologies being moved into the domestic and international marketplace. Clean coal technologies being demonstrated under the CCT program are creating the technology base that allows the nation to meet its energy and environmental goals efficiently and reliably. The fact that most of the demonstrations are being conducted at commercial scale, in actual user environments, and under conditions typical of commercial operations allows the potential of the technologies to be evaluated in their intended commercial applications. The technologies are categorized into four market sectors: advanced electric power generation systems; environmental control devices; coal processing equipment for clean fuels; and industrial technologies. Sections of this report describe the following: Role of the Program; Program implementation; Funding and costs; The road to commercial realization; Results from completed projects; Results and accomplishments from ongoing projects; and Project fact sheets. Projects include fluidized-bed combustion, integrated gasification combined-cycle power plants, advanced combustion and heat engines, nitrogen oxide control technologies, sulfur dioxide control technologies, combined SO_2 and NO_x technologies, coal preparation techniques, mild gasification, and indirect liquefaction. Industrial applications include injection systems for blast furnaces, coke oven gas cleaning systems, power generation from coal/ore reduction, a cyclone combustor with S, N, and ash control, cement kiln flue gas scrubber, and pulse combustion for steam coal gasification.

21386 (DOE/GO–10095-076) **HBCU Program at Tennessee State University.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE93017082. Source: OSTI; NTIS; GPO Dep.

Historically and predominantly black colleges and universities (HBCUs) need to have a strong research capability to graduate engineering students with strong skills for competing in industry. The US Department of Energy's (DOE's) Office of Building Technologies (OBT) is working with HBCUs to help them develop that capability through its HBCU Program. The HBCU program has two goals: to help these institutions develop a research capability; to contribute to OBT's research needs. The program accomplishes these goals by helping institutions select a research topic with a strong engineering or science content, prepare a research proposal, and execute the work. This pamphlet describes the research on heat pump refrigerants at Tennessee State University.

21387 (DOE/GO–10095-153) **Technology partnerships: Enhancing the competitiveness, efficiency, and environmental quality of American industry. Executive summary.** National Renewable Energy Lab., Golden, CO (United States). Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004060. Source: OSTI; NTIS; GPO Dep.

This document briefly describes the Department of Energy's (DOE's) Office of Industrial Technologies (OIT) program. It profiles the energy, economic, and environmental characteristics of OIT's principal customers–the materials and process industries–that consume nearly 80% of all energy used by industry in the US. OIT-supported research, development, and demonstration (RD and D) activities relating to these industries are described as well as OIT's crosscutting technology programs that target the needs of multiple US industries. Quantitative estimates of the potential benefits (or metrics) to US industry of many current OIT-supported technologies are also discussed.

21388 (DOE/IG–0373) **Audit of Administration of Cooperative Research and Development Agreements at DOE National Laboratories.** USDOE Office of Inspector General, Albuquerque, NM (United States). Western Regional Audit Office. 19 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI.

Report to The Secretary.

DOE established policies to ensure that Cooperative Research and Development Agreements (CRADAS) enhance US competitiveness in the world economy, provide a reasonable return on resources invested, and enable successful commercialization of technologies developed. DOE's Office of Technology Partnerships issued a General Guidance Memorandum to DOE operations offices establishing policy goals for technology transfer programs, including CRADAS. Our audit disclosed that efforts to manage CRADAs at three national laboratories did not fully achieve DOE's policy goals outlined in the General Guidance Memorandum. Specifically, the audit showed that: (1) joint work statements did not always contain clearly defined information that allowed DOE to facilitate technology transfer or to evaluate CRADAs potential benefits; (2) CRADA statements of work did not always contain adequate documentation or address potential benefits; (3) the national laboratories reviewed did not have effective mechanisms for continuous self-appraisal or measures of overall program success; and (4) CRADA provisions did not exist to ensure an accurate evaluation of partner contributions.

21389 (INPO–95011853) **Institute of Nuclear Power Operations annual report, 1993.** Institute of Nuclear Power Operations, Atlanta, GA (United States). [1993]. 40p. Order Number DE95011853. Source: OSTI; INIS; NTIS; Institute of Nuclear Power Operations, 700 Galleria Parkway, Atlanta, GA 30339-5957 (United States).

This annual report highlights the activities of the Institute of Nuclear Power Operations. The topics of the report include the president and chairmen's joint message, overview of programs serving as the foundation for most of its activities, performance indicators for the US nuclear utility industry, and INPO's 1993 financial reports and rosters. INPO has four technical cornerstone programs that serve as the foundation for most of its activities. (1) Evaluations of nuclear power plants operated by member utilities are conducted on a regularly scheduled basis. (2) INPO supports its member utilities in their work to achieve and maintain accreditation of training programs. (3) Events analysis programs identify and communicate lessons learned from plant events so utilities can take action to prevent similar events at their plants. (4) INPO helps members improve in nuclear operations areas through assistance programs and other activities that continually evolve to meet the changing needs of the nuclear industry.

21390 (INPO–95012838) **Institute of Nuclear Power Operations 1994 annual report.** Institute of Nuclear Power Operations, Atlanta, GA (United States). [1994]. 41p. Order Number DE95012838. Source: OSTI; INIS; NTIS; Institute of Nuclear Power Operations, 700 Galleria Parkway, Atlanta, GA 30339-5957 (United States).

This annual report highlights the activities of the Institute of Nuclear Power Operations. The topics of the report include the president and chairmen's joint message, overview of programs serving as the foundation for most of its activities, performance indicators for the US nuclear utility industry, and INPO's 1994 financial reports and rosters. INPO has four technical cornerstone programs that serve as the foundation for most of its activities. (1) Evaluations of nuclear power plants operated by member utilities are conducted on a regularly scheduled basis. (2) INPO supports its member utilities in their work to achieve and maintain accreditation of training programs. (3) Events analysis programs identify and communicate lessons learned from plant events so utilities can take action to prevent similar events at their plants. (4) INPO helps members improve in nuclear operations areas through assistance programs and other activities that continually evolve to meet the changing needs of the nuclear industry.

21391 (LBL-PUB–3125-Vol.2) **Research programs at the Department of Energy National Laboratories. Volume 2: Laboratory matrix.** Argonne National Lab., IL (United States);

Brookhaven National Lab., Upton, NY (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States); Lawrence Berkeley Lab., CA (United States); Lawrence Livermore National Lab., CA (United States); Los Alamos National Lab., NM (United States); Oak Ridge National Lab., TN (United States); Pacific Northwest Lab., Richland, WA (United States); Sandia National Labs., Livermore, CA (United States); Sandia National Labs., Albuquerque, NM (United States); NationalDec 1994. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC02-76CH00016 ; AC07-76ID01570 ; AC03-76SF00098 ; W-7405-ENG-48 ; W-7405-ENG-36 ; AC05-84OR21400 Order Number DE95012367. Source: OSTI; NTIS; GPO Dep.

For nearly fifty years, the US national laboratories, under the direction of the Department of Energy, have maintained a tradition of outstanding scientific research and innovative technological development. With the end of the Cold War, their roles have undergone profound changes. Although many of their original priorities remain–stewardship of the nation's nuclear stockpile, for example–pressing budget constraints and new federal mandates have altered their focus. Promotion of energy efficiency, environmental restoration, human health, and technology partnerships with the goal of enhancing US economic and technological competitiveness are key new priorities. The multiprogram national laboratories offer unparalleled expertise in meeting the challenge of changing priorities. This volume aims to demonstrate each laboratory's uniqueness in applying this expertise. It describes the laboratories' activities in eleven broad areas of research that most or all share in common. Each section of this volume is devoted to a single laboratory. Those included are: Argonne National Laboratory; Brookhaven National Laboratory; Idaho National Engineering Laboratory; Lawrence Berkeley Laboratory; Lawrence Livermore National Laboratory; Los Alamos National Laboratory; National Renewable Energy Laboratory; Oak Ridge National Laboratory; Pacific Northwest Laboratory; and Sandia National Laboratories. The information in this volume was provided by the multiprogram national laboratories and compiled at Lawrence Berkeley Laboratory.

21392 (LBL-PUB–5396) **Lawrence Berkeley Laboratory Institutional Plan FY 1995–2000.** Lawrence Berkeley Lab., CA (United States). Dec 1994. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95011292. Source: OSTI; NTIS; GPO Dep.

This report presents the details of the mission and strategic plan for Lawrence Berkeley Laboratory during the fiscal years of 1995–2000. It presents summaries of current programs and potential changes; critical success factors such as human resources; management practices; budgetary allowances; and technical and administrative initiatives.

21393 (NEDO-P–9322) **Feasibility study of developing energy combined technology. 2.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 220p. (In Japanese). Order Number DE95786804. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

A study was made on feasibility of developing technology aiming at a combined utilization form of new energy. First, as a combined system using a functional medium, proposed was an energy system using hydrogen as an energy medium. Next, as an energy combined system with key technology as core, proposed were energy combined systems using as core methanol, chemical heat pump, plasma direct power generation, energy storage technology, environmental technology, etc. Further, as a combined system using characteristics of areas/sections, proposed was ECLIPSE (energy cascade for living and industry pursuing soundness and economy). Also proposed were a hydrogen medium energy application system, a night power application type sewage disposal treatment system, a biomass/solar total system, and a water resource production combined system. Hereafter, screening of the systems proposed and the feasibility study are carried out. 32 refs., 54 figs., 9 tabs.

21394 (NEI-DK–2004) **Energy research program 94. Supplement to Energy Research 1994. Program for expansion of Danish energy research and development during 1994-96.** Energistyrelsen, Copenhagen (Denmark). Mar 1995. 137p. (In Danish). Order Number DE95779205. Source: OSTI; NTIS.

This supplement to the document named 'Energiforskning 1994' gives print-outs of the Danish input from the database Nordisk Energi Index, (NEI, (Nordic Energy Index)). Risoe Library, at Risoe National Laboratory, is responsible for the coordination and the input to NEI of descriptions of energy research projects carried out in individual Nordic countries. The descriptions showed on the print-outs give project titles, summary descriptions of aims, methods etc., names, addresses, telephone and telefax numbers of institutions etc. responsible for the projects, names of project leaders, of other involved firms, institutes or institutions, and details of the total budget and the financing of the energy research projects. (AB)

21395 (NEI-DK–2046) **Research and development related to oil and natural gas 1995 - 1999. Supplement to the plan of management.** Energistyrelsen, Copenhagen (Denmark). Mar 1994. 54p. (In Danish). Order Number DE95787758. Source: OSTI; NTIS.

This supplement to the document of the same title contains the mandate of the working groups attached to the Danish governmental committee on research related to oil and natural gas. The working groups' recommendations are presented in the original wording. (AB)

21396 (ORNL/M–4087) **The Center for Environmental Technology Innovative Technology Screening Process.** Bertrand, C.M. Oak Ridge National Lab., TN (United States). Feb 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95008966. Source: OSTI; NTIS; INIS; GPO Dep.

The Center for Environmental Technology's (CET) mission is to provide a fully integrated system for accelerated evaluation, development, commercialization, and public acceptance of creative environmental solutions which match the foremost demands in today's environmentally sensitive world. In short, CET will create a means to provide quick, effective solutions for environmental needs. To meet this mission objective, CET has created a unique and innovative approach to eliminating the usual barriers in developing and testing environmental technologies. The approach paves the way for these emerging, cutting-edge technologies by coordinating environmental restoration and waste management activities of industry, universities, and the government to: efficiently and effectively transfer technology to these users, provide market-driven, cost-effective technology programs to the public and DOE, and aid in developing innovative ideas by initiating efforts between DOE facilities and private industry. The central part to this mission is selecting and evaluating specific innovative technologies for demonstration and application at United States Department of Energy (DOE) installations. The methodology and criteria used for this selection, which is called the CET Innovative Technology Screening Process, is the subject of this paper. The selection criteria used for the screening process were modeled after other DOE technology transfer programs and were further developed by CET's Technology Screening and Evaluation Board (TSEB). The process benefits both CET and the proposing vendors by providing objective selection procedures based on predefined criteria. The selection process ensures a rapid response to proposing vendors, all technologies will have the opportunity to enter the selection process, and all technologies are evaluated on the same scale and with identical criteria.

21397 (PNL-SA–26066) **Demonstrating and implementing innovative technologies: Case studies from the USDOE Office of Technology Development.** Brouns, T.M. (Pacific Northwest Lab., Richland, WA (United States)); Koegler, K.J.; Mamiya, L.S. Pacific Northwest Lab., Richland, WA (United States). Feb 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950216–136: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95011492. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes elements of success for demonstration, evaluation, and transfer for deployment of innovative technologies for environmental restoration. They have been compiled from lessons learned through the US Department of Energy (DOE) Office of Technology Development's Volatile Organic Compounds in Arid Soil Integrated Demonstration (VOC-Arid ID). The success of

the VOC-Arid ID program was determined by the rapid development demonstration, and transfer for deployment of technologies to operational sites that improve on safety, cost, and/or schedule of performance over baseline technologies. The VOC-Arid ID successfully fielded more than 25 innovative technology field demonstrations; several of the technologies demonstrated have been successfully transferred for deployment Field demonstration is a critical element in the successful transfer of innovative technologies into environmental restoration operations. The measures of success for technology demonstrations include conducting the demonstration in a safe and controlled environment and generating the appropriate information by which to evaluate the technology. However, field demonstrations alone do not guarantee successful transfer for deployment There are many key elements throughout the development and demonstration process that have a significant impact on the success of a technology. This paper presents key elements for a successful technology demonstration and transfer for deployment identified through the experiences of the VOC-Arid ID. Also, several case studies are provided as examples.

21398 (SAND–95-0430) **Petroleum and geothermal production technology in Russia: Summary of information obtained during informational meetings with several Russian institutes.** Schafer, D.M.; Glowka, D.A.; Teufel, L.W. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012523. Source: OSTI; NTIS; GPO Dep.

Russian scientists and engineers have drilled the deepest holes in the world. It is recognized that this experience has given them an expertise in drilling superdeep holes, as well as other aspects of drilling, completions, and geophysics. More and more US oil and gas companies are vigorously expanding their exploration and development into Russia. It is important for them to identify and use Russian technology in drilling, completion, logging, and reservoir characterization to the extent possible, in order to both reduce drilling costs and help support the Russian economy. While these US companies are interested in becoming involved in and/or sponsoring research in Russia, they have been unsure as to which scientists and institutes are working on problems of interest. It was also important to determine in which areas Russian technology is farther advanced than in the West. Such technology could then be commercialized as part of the Industrial Partnering Program. In order to develop a clear understanding of these issues, two Sandia engineers with drilling and completions expertise and a geophysicist with expertise in reservoir analysis traveled to Russia to meet with Russian scientists and engineers to discuss their technologies and areas of interest. This report contains a summary of the information obtained during the visit.

21399 (UCRL–52000-95-1/2) **Energy and technology review, January–February 1995. State of the laboratory.** Bookless, W.A.; Stull, S.; Cassady, C.; Kaiper, G.; Ledbetter, G.; McElroy, L.; Parker, A. (eds.). Lawrence Livermore National Lab., CA (United States). Feb 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012112. Source: OSTI; NTIS; GPO Dep.

This issue of Energy and Technology Review highlights the Laboratory's 1994 accomplishments in their mission areas and core programs–economic competitiveness, national security, lasers, energy, the environment, biology and biotechnology, engineering, physics and space science, chemistry and materials science, computations, and science and math education. LLNL is a major national resource of science and technology expertise, and they are committed to applying this expertise to meet vital national needs.

21400 (UCRL-ID–118619-Rev.1) **Transfer of Air Force technical procurement bid set data to small businesses, using CALS and EDI. Summary report. Revision 1.** Lawrence Livermore National Lab., CA (United States). 10 Jan 1995. 31p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (AITI–94-ED-01). Order Number DE95009559. Source: OSTI; NTIS; GPO Dep.

This report provides a summary of the Air Force CALS Test Network (AFCTN) Test Report Transfer of Air Force Technical Procurement Bid Set Data to Small Businesses, Using CALS and EDI (AFCTN Test Report 94-034, UCRL-ID-118619). It represents a synthesis of the results, conclusions, and recommendations, as well as a more concise presentation of the issues and strategies as viewed from AFCTN's perspective. This report documents a test transfer of three Air Force technical procurement bid sets to one large and twelve small businesses, using the Department of Defense (DoD) Continuous Acquisition and Life-cycle Support (CALS) and ANSI ASC X12 Electronic Data Interchange (EDI) standards. The main goal of the test was to evaluate the effectiveness of using CALS technical data within the context of the DoD's EDI-based standard approach to electronic commerce in procurement, with particular emphasis on receipt and use of the data by small contractors. Air Force procurement data was provided by the Sacramento Air Logistics Center at McClellan Air Force Base; the manufacturing participants were selected from among McClellan's 'Blue Ribbon' contractors, located throughout the United States. The test was sponsored by the Air Force CALS Test Network, headquartered at Wright-Patterson Air Force Base. The test successfully demonstrated the technical feasibility of including CALS MIL-R-28002 (Raster) engineering data in an EDI Specification/ Technical Information transaction set (ANSI ASC X12 841) when issuing electronic requests for quotation to small businesses. In many cases, the data was complete enough for the contractor participant to feel comfortable generating a quote.

21401 (UCRL-JC–118960) **Will man wish to prevail? Some fundamental choices facing humanity early in the Third Millennium.** Wood, L.L. Lawrence Livermore National Lab., CA (United States). Oct 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410345–1: 3. Millennium: man, his limits and his hopes, Vareena (Italy), 2-6 Oct 1994). Order Number DE95010263. Source: OSTI; NTIS; GPO Dep.

With the subtle but occasionally vital exception of vaccination-induced immunity to many of the major infectious diseases, no human today is other than virtually identical biologically to those who greeted the dawn of the Second Millennium, nearly 1000 years ago. Culturally, however, we of the West are quite highly evolved from our ancestors of a millennium ago, primarily due to the advent of means for communicating with ever smaller latencies and ever higher bandwidths over ever greater distances in space and time: printed documents have been supplemented in succession by telephony, radio, video and, just now, the first personal communications sets. Also, within a fraction of a human lifetime from the present moment, the first prosthesis for the human brain has appeared and just very recently has become quite ubiquitous: digital computing systems. We are hardly members of the same species, culturally speaking; people of 1000 years ago would be truly and utterly lost in our communications-intensive civilization, and even a highly educated person from those times would swear that a personal computer equipped with a wireless communications module was as at least a familiar, if not a golem. Conversely, a computer-using person from our own times somehow translated back to 1000 A.D. would likely find the profound isolation and the "informational slowness" of life then to be acutely intolerable, certainly to a far greater extent than would a citizen of the High Middle Ages translated back to Augustus Caesar's Rome.

2906 Nuclear Energy

Refer also to citation(s) 20834, 21048, 21389, 21390, 21543, 21544, 21545, 21546, 21547, 21548

21402 (DOE/EIA–0436(94)) **World nuclear outlook 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. Dec 1994. 131p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011851. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

As part of the EIA program to provide energy information, this analysis report presents the current status and projections through 2010 of nuclear capacity, generation, and fuel cycle requirements

for all countries in the world using nuclear power to generate electricity for commercial use. It also contains information and forecasts of developments in the uranium market. Long-term projections of US nuclear capacity, generation, and spent fuel discharges for three different scenarios through 2040 are developed for the Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM). In turn, the OCRWM provides partial funding for preparation of this report. The projections of uranium requirements are provided to the Organization for Economic Cooperation and Development (OECD) for preparation of the Nuclear Energy Agency/OECD report, Summary of Nuclear Power and Fuel Cycle Data in OECD Member Countries.

21403 (DOE/S–0112) **Semiannual report to Congress on Inspector General Audit Reports, October 1, 1994–March 31, 1995.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013665. Source: OSTI; NTIS; GPO Dep.

This is the Secretary of Energy's twelfth Semiannual Report to Congress submitted under the Inspector General Act of 1978, as amended. Pursuant to the Inspector General Act Amendments of 1988 (Public Law 100-504), agency heads are to report to Congress on the status of final action taken on audit report recommendations. This report complements a report prepared by the Department's Office of Inspector General that provides information on audit reports issued during the period and on the status of management decisions made on Inspector General audit reports. During the period covered by this report, October 1, 1994 through March 31, 1995, the Department took final action on 32 operational, financial, and preaward audit reports. At the end of the period 90 reports awaited final action. Final action was taken on four contract and financial assistance audits, leaving four reports requiring final action at the end of the period. This report has three sections. The first section outlines significant audit resolution and followup accomplishments achieved by the Department during the reporting period. The second section contains the statistical tables that illustrate the status of final action on Inspector General audit reports. The third lists the audit reports that are one year or more past management decision and have not completed final action. This section also provides the status of corrective actions on each of these reports.

21404 (LA–12556-C, pp. 149-152) **Office of Nuclear Safety (NS) activities for 1992.** Fergus, I. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Nuclear Safety (NS) has undertaken several activities relating to nuclear criticality safety. For example, NS worked with Nuclear Energy (NE) on draft DOE 5480. CRIT, Nuclear Criticality Safety. NS concurred with the approach adopted by NE to streamline the DOE Order and rely mainly on mandatory American National Standards Institute (ANSI)/American Nuclear Society (ANS) standards where appropriate. NS concurred with minimizing sections of DOE Orders that repeated or restated "shall" statements in mandatory standards. NS accepted resolution of some of its comments on DOE 5480.CRIT based on NE's commitment to provide additional guidance in a Criticality Safety Program Guide. In the interim, NS is relying on performance assessments of nuclear criticality safety based on comparisons with best industry practices.

21405 (LA–12556-C, pp. 153-158) **Development of a criticality safety program guide for DOE nonreactor nuclear facilities.** Hopper, C.M. (Oak Ridge National Lab., TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a presentation and discussion of the US DOE's efforts to develop a NCS program guide for the implementation of 10CFR830.380. Topics of discussion were: (1) introduction/general practices; (2) definition of terms; (3) administration; (4) NCSA guidelines; (5) calculations; (6) conduct of operations; (7) state support; and (8) emergency preparedness.

21406 (LA–12556-C, pp. 159-163) **Revision 3 of TID-7016 "The Nuclear Safety Guide".** Pruvost, N.L. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this presentation is to review the status of Revision 3 of TID-7016. Revision 3 has been in progress for about two years and should be published about one year from now. The publication will be unclassified and is supported jointly by DOE and NRC. The Nuclear Safety Guide was first issued in 1956 as a classified AEC report (LA-2063). Revision 1 appeared in 1961 as an unclassified document, and Revision 2, again unclassified, appeared in 1978. I think that the purpose of the Guide remains as stated in the forward of Revision 1.

21407 (LA–12556-C, pp. 164-176) **DOE scientific and technical information management.** Beasly, M. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a discussion of the mission objectives and program activities of the DOE Office of Scientific and Technical Information. Topics of discussion were: (1) program direction and structure; (2) representation in gov't and international organizations; (3) management of information; and (4) consultation and assistance.

21408 (LA–12556-C, pp. 177-182) **Criticality safety database.** Beasley, M. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a discussion of a NCS database using commercially available software (dBase III and dBase IV). Major topics of the database included geometries, processes, fissile and non-fissile materials, poisons. Database entries by topic, by publisher, and by year were presented.

21409 (LA–12556-C, pp. 184-188) **Price-Anderson Amendments Act, Code of Federal Regulations, DOE Orders, and ANSI-standards.** Malenfant, R.E. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a brief discussion of ongoing changes to two Price-Anderson Act, including 10CFR 820, 830, 834, and 835. Future rulemaking activities were also noted.

21410 (LA–12556-C, pp. 189-204) **Comments on 10 CFR 820, 830, 835 proposed safety rules for DOE nuclear activities.** Bergman, G. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a discussion of LANL's comments to draft 10CFR 820, 830, and 835. In general comments, LANL recognized the authority of the governing organization but contended that: (1) the rules/approach needed major revision, (2) the rules are counterproductive, and (3) teamwork is reg'd in order to meet the goals.

21411 (LA–12556-C, pp. 205-206) **A community in transition.** Rutherford, D.A. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was an overview of ongoing changes in the NCS community. Specific discussions included the order and rule-making process and transition activities of LACEF.

2910 Conservation

Refer also to citation(s) 21360, 21422, 21423, 21430, 21476

21412 (CONF-950643–2) **Utility investments in low-income energy-efficiency programs.** Brown, M.A. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. national demand-side management conference: delivering customer value; Dallas, TX (United States); 28-30 Jun 1995. Order Number DE95013208. Source: OSTI; NTIS; GPO Dep.

In the increasingly competitive utility industry, it is imperative that equity programs be as cost-effective as possible. In some cases, this is accomplished by working in partnership with government programs such as the US Department of Energy's low-income Weatherization Assistance Program. This paper provides an overview of the DSM and conservation programs being operated by utilities for low-income customers and describes the types of utility-government partnerships that exist.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 20649, 20653, 21402, 21424

21413 (ANL/OTD-EEST/CP–85089) **Energy technologies and their impact on demand.** Drucker, H. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950138–1: 3. annual Middle East petroleum and gas conference: the re-emergence of oil giants, Muscat (Oman), 15-17 Jan 1995). Order Number DE95012945. Source: OSTI; NTIS; GPO Dep.

Despite the uncertainties, energy demand forecasts must be made to guide government policies and public and private-sector capital investment programs. Three principles can be identified in considering long-term energy prospects. First energy demand will continue to grow, driven by population growth, economic development, and the current low per capita energy consumption in developing countries. Second, energy technology advancements alone will not solve the problem. Energy-efficient technologies, renewable resource technologies, and advanced electric power technologies will all play a major role but will not be able to keep up with the growth in world energy demand. Third, environmental concerns will limit the energy technology choices. Increasing concern for environmental protection around the world will restrict primarily large, centralized energy supply facilities. The conclusion is that energy system diversity is the only solution. The energy system must be planned with consideration of both supply and demand technologies, must not rely on a single source of energy, must take advantage of all available technologies that are specially suited to unique local conditions, must be built with long-term perspectives, and must be able to adapt to change.

21414 (DOE/EIA–0202(95/2Q)) **Short-term energy outlook: Quarterly projections. Second quarter 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 2 May 1995. 49p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011898. Source: OSTI; NTIS; GPO; GPO Dep.

The Energy Information Administration (EIA) prepares quarterly, short-term energy supply, demand, and price projections for publication in February, May, August, and November in the Short-Term Energy Outlook (Outlook). An annual supplement analyzes the performance of previous forecasts, compares recent projections with those of other forecasting services, and discusses current topics related to the short-term energy markets. (See Short-Term Energy Outlook Annual Supplement, DOE/EIA-0202.) The forecast period for this issue of the Outlook extends from the second quarter of 1995 through the fourth quarter of 1996. Values for the first quarter of 1995, however, are preliminary EIA estimates (for example, some monthly values for petroleum supply and disposition are derived in part from weekly data reported in the Weekly Petroleum Status Report) or are calculated from model simulations using the latest exogenous information available (for example, electricity sales and generation are simulated using actual weather data). The historical energy data, compiled into the second quarter 1995 version of the Short-Term Integrated Forecasting System (STIFS) database, are mostly EIA data regularly published in the Monthly Energy Review, Petroleum Supply Monthly, and other EIA publications. Minor discrepancies between the data in these publications and the historical data in this Outlook are due to independent rounding. The STIFS database is archived quarterly and is available from the National Technical Information Service.

21415 (DOE/EP/10050–T6) **Indochina energy outlook. Report series Number 3.** Johnson, C.J.; Lamke, A.J.; Li, B. East-West Center, Honolulu, HI (United States). May 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-93EP10050. Order Number DE95012422. Source: OSTI; NTIS; GPO Dep.

Indochina contains large energy resources of oil, gas, coal, and hydropower, and will become an important oil, gas, and electricity exporter in Southeast Asia over the next decade. The combination of substantial energy resources and economic reforms in Vietnam, Laos, and Cambodia are attracting major investments in the energy sector. This report discusses the economy; the resources, reserves, and projected production of oil, gas, coal, and hydropower; and electric power in Vietnam, Cambodia, and Laos. 10 refs., 7 figs., 3 tabs.

21416 (NEI-DK–2063) **End-use energy modelling for developing countries. A review of the end-use approach for projecting long-term energy use and GHG emissions.** Working Paper, 2. Sathaye, J.A. (Lawrence Berkeley Laboratory, Berkeley, CA (United States)). United Nations Environment Programme, Roskilde (Denmark). Collaborating Centre on Energy and Environment. Apr 1995. 43p. Order Number DE95787842. Source: OSTI; NTIS.

The end-use approach to the estimation of long-term energy demand and supply and the consequent emission of greenhouse gases are described. The approach consists of classifying energy demand according to its major end uses. Energy use is linked to the service provided by an end-use. The approach begins with the most detailed level of end-use and combines the detailed energy use into a more aggregated energy projection at the sectoral level. The sectoral energy use is added to yield the total energy demand by fuel type. The supply of primary energy is estimated on the basis of the demand for individual fuels and electricity for each major end use in each economic sector. The end-use approach uses projections of economic activity by sector, population, urbanization, electrification, etc. as determinants of energy demand. An approach which uses international comparisons as a basis for determining the future consumption and saturation of material goods, e.g., the saturation of consumer goods, such as appliances and cars is explained. This method assumes that developing countries will eventually reach income levels similar to those enjoyed by more developed economics. Factors for example, such as distances travelled per car, fuel use per kilometer and levels of car ownership determine the energy demand for automobiles. The availability of fuels and their relative prices as influenced by government policies determine the choice of fuels. Better methods of regular bottom-up data collection through end-use surveys need to be standardized for improved understanding and projections of energy demand in a developing country. End-use analysis will benefit energy planners and forecasters by helping to design targeted policies to improve the efficiency of energy supply. (AB) 38 refs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 21006, 21018, 21213, 21342, 21371, 21374, 21375, 21376

21417 (NEI-DK–2017) **Nordic energy- and trade- political cooperation 1994-1995 (per 1 december 1994).** Nordisk Ministerraad. 1994. 66p. (In Norwegian, Swedish). Order Number DE95779222. Source: OSTI; NTIS.

This publication gives a survey of the respective Nordic Minister Councils and Committees and the accepted activity plans for energy sector and commercial sector. All the active groups and institutions are described concerning their purpose/mandate and their national representation (per 1 December 1994). A list of the Nordic reports published by the cooperating countries in the period 1.1.1994-1.12.1994 and scheme of the Nordic Minister Council organization is given. An address directory of the business and commercial organizations with connections to the Nordic commercial and energy political cooperation has been collected in the end of this publication. (EG)

2940 Fossil Fuels

Refer also to citation(s) 20567, 20649, 20653, 20655, 20656, 20661, 20707, 21337, 21383, 21385, 21414, 21415, 21427, 21436, 21445

21418 (DOE/MC/30084–3864) **The feasibility assessment of a U.S. natural gas production reporting system uniform production reporting model. Final report, July 1993–June 1994.** Oklahoma Univ., Norman, OK (United States). Sarkeys Energy Center. Jun 1994. 560p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-93MC30084. Order Number DE95000078. Source: OSTI; NTIS; GPO Dep.

The Uniform Production Reporting Model (UPRM) project was charged with identifying the best practices and procedures of the natural gas producing states related to the gathering, management, and dissemination of production data. It is recommended that the producing states begin the process of upgrading state systems using the concepts embodied in the UPRM model.

21419 (IEE-SR–261) **Trends of the gulf oil-producing countries, EU, and majors coping with variation in international balance between supply and demand of oil.** Institute of Energy Economics, Tokyo (Japan). Dec 1994. 175p. (In Japanese). Order Number DE95786742. Source: OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo, Japan.

This is a record in 1993 on research of rationalization of oil distribution entrusted by the Resources and Energy Agency. The following trends were cached, and the two items (i.e., oil production policies of main countries of OPEC and recent trends of majors, and trends of EU's energy policy and energy laws in Russia) were studied. In future, a rise in demand in developing contries and large dependence on the Middle East caused by limitation of surplus production increase by non-the Middle East and non-OPEC countries are predicted. In spite of a large estimated amount of oil, there are some cases where economics and technologies limit maintenance of production ability. And global environmental problems, and increase in LNG demand, and privatization of the oil industry by part of oil-production countries (e.g., the Central South American countries) will effect closely on strategies between oil-producting countries and enterprises in the Western bloc. There is a possibility of rapid development of new oil and LNG by Western capitals in Russia. 47 refs., 46 figs., 48 tabs.

21420 (NEI-DK–2047) **Research and development related to oil and natural gas 1995 - 1999. Plan of management.** Energistyrelsen, Copenhagen (Denmark). Mar 1994. 14p. (In Danish). Order Number DE95787753. Source: OSTI; NTIS.

Danish production of North Sea oil commenced in 1971. Now the country produces its own domestic supplies and also exports oil and gas. This production is of great importance to the economy, at least until the middle of the next century, and the use of natural gas plays a special role in the planned reduction of carbon dioxide emission. The Danish government subsidizes research in this area, and the document presents the latest plan of management for the coming research programme. The overall aims, preconditions, the priorities given and the economic framework are specified. Suggestions for mediating results of the research projects are given. Priority is given to follow-up research, recovery, equipment and plants, and these are described. (AB)

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 21393

21421 (ETDE-DE–127) **Norwegian Hydro Energy in Germany (NHEG). Executive summary.** Andreassen, K. (Norsk Hydro A.S. Research Centre Porsgrunn (Norway)); Buenger, U. Ludwig-Boelkow-Systemtechnik (LBST), Ottobrunn (Germany). 15 May 1992. 25p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany);Commission of the European Communities, Luxembourg (Luxembourg). Foerderkennzeichen BMFT 0329147A. Order Number DE95786068. Source: OSTI; NTIS (US Sales Only).

Transfer of renewable energy from remote areas to energy intensive industrial regions might be of prospective importance. The case study NHEG considers a system where Norwegian hydro energy is exported to Germany as hydrogen or electricity. The aim is to evaluate the technical and economical feasibility of a demonstration project paving the way for larger commercial projects in the future. Primarily hydrogen is considered as the energy carrier. Liquid hydrogen is produced in North-Norway, shipped to German ports and distributed to specific cities. Three alternatives are studied. The reference case is based on 100 MW hydro power, the two others on 20 MW. In the former a ship with fixed cryogenic tanks is applied for the LH_2 maritime transportation and cryogenic 40' containers with ISO standard dimensions for distribution to the users. In the latter ones the containers are supposed to be used for both transportation and distribution. In all cases evaporated GH_2 is assumed to be returned to the production plant for reliquefaction. The study indicates that the most interesting demonstration project should be a system using about 20 MW_{el} and having a production rate of 4.000 Nm^3 GH_2 per hour from an existing electrolysis plant. This may bring about 40.000 m^3 LH_2 per year to the customers and have an overall energy efficiency of about 58%. The capital investment including storage in a German port may be about 87 MDEM and the cumulative product cost about 0,25 DEM/kWh_{th}. Including distribution of LH_2 in Berlin as one example may increase the investment to about 114 MDEM and the product cost to about 0,31 DEM/kWh_{th} on today's premises. Long distance transmission of electricity may be an alternative to hydrogen transport. If electricity from Norway is used for liquid hydrogen production in Germany, the product cost will under realistic conditions be nearly the same as for imported LH_2. (orig.)

2960 Electric Power

Refer also to citation(s) 21172, 21323, 21389, 21390, 21412, 21414, 21415, 21436

21422 (CONF-950643–1) **What has DSM achieved in California?.** Brown, M.A. (Oak Ridge National Lab., TN (United States)); Mihlmester, P.E. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. national demand-side management conference: delivering customer value; Dallas, TX (United States); 28-30 Jun 1995. Order Number DE95012883. Source: OSTI; NTIS; GPO Dep.

Since the late 1980's, the four largest California investor-owned utilities have initiated and expanded various demand-side management (DSM) programs designed to produce energy and capacity savings and to provide comprehensive services to their customers. This commitment to energy efficiency was encouraged by the establishment of financial incentives for the utilities to acquire demand-side resources. The four utilities include: Pacific Gas and Electric Company (PG&E); San Diego Gas and Electric Company (SDG&E); and Southern California Edison (SCE), and Southern California Gas Company (SoCalGas). This paper summarizes the

results of 50 evaluation studies that assess California DSM programs operating between 1990 and 1992. The report concludes that in aggregate the California DSM programs outperformed DSM programs from the 1980's, in terms of more accurately forecasting energy and demand impacts.

21423 (CONF-950817–1) **Actual vs anticipated savings from DSM programs: An assessment of the California experience.** Brown, M.A. (Oak Ridge National Lab., TN (United States)); Mihlmester, P.E. Oak Ridge National Lab., TN (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-25 Aug 1995. Order Number DE95012882. Source: OSTI; NTIS; GPO Dep.

Since the late 1980's, utilities in California have used demand-side management (DSM) extensively to achieve a variety of corporate and public policy goals. This commitment to ene efficiency was encouraged by the establishment of financial incentives for the utilities to acquire demand-side resources. With restructuring of electric and gas markets underway in California, including recent cutbacks by the California utilities in their DSM program efforts, it is timely to review retrospectively the accomplishments of California's DSM investments. This paper summarizes the results of 50 evaluation studies that assess California DSM programs operating between 1990 and 1992. On average, the programs delivered 112% of the energy savings that were planned, and the typical program realized approximately 86% of the energy savings it was expected to deliver. Thus, the California DSM programs outperformed DSM programs from the 1980s, in terms of more accurately forecasting energy impacts. Among the 50 impact studies, lower realization rates are associated with residential-sector programs, relatively high ex-ante estimates of savings, and significant levels of free ridership.

21424 (CONF-950817–3) **Applying DSM evaluation results to utility planning.** Baxter, L.W. Oak Ridge National Lab., TN (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-25 Aug 1995. Order Number DE95013994. Source: OSTI; NTIS; GPO Dep.

This paper describes the results of a study to assess the application of DSM evaluation results to utility forecasting and planning. The paper has three objectives: (1) identify forecasting and planning applications of evaluation studies, (2) identify major obstacles and problems associated with applying evaluation results to forecasting and planning, and (3) suggest approaches to address the major problems. The paper summarizes results from interviews with utilities, regulators, and consultants to determine how the utility industry currently applies evaluation results in forecasting and planning. The paper also includes results from a detailed case study of Sacramento Municipal Utility District (SMUD) and Southern California Edison Company (SCE), two utilities with large DSM programs and active evaluation efforts.

21425 (DOE/EIA–0226(95/05)) **Electric power monthly, May 1995 with data for February 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 24 May 1995. 203p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012802. Source: OSTI; NTIS; GPO; GPO Dep.

The Electric Power Monthly (EPM) presents monthly electricity statistics for a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The purpose of this publication is to provide energy decisiommakers with accurate and timely information that may be used in forming various perspectives on electric issues that lie ahead. The publication provides monthly statistics at the State, Census division, and US levels for net generation, fossil fuel consumption and stocks, quantity and quality of fossil fuel, cost of fossil fuels, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fossil fuels are also displayed for the North American Electric Reliability Council (NERC) regions. The EIA publishes statistics in the EPM on net generation by energy source; consumption, stocks, quantity, quality, and cost of fossil fuels; and capability of new generating units by company and plant.

21426 (DOE/IG–0372) **The inspection of power purchase contracts at the Western Area Power Administration.** USDOE Office of Inspector General, Washington, DC (United States). Office of Inspections. May 1995. 45p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The Office of Inspector General received an allegation regarding possible irregularities in certain power purchase contracts awarded by the Western Area Power Administration (WAPA). Based on our survey of WAPA's power purchase procedures, we expanded our allegation based inquiry to include several management issues. Thus, the purpose of this inspection was to review the specific allegation as well as to evaluate WAPA's power purchase contracting procedures relating to competition, the documentation of the solicitation, negotiation, and award processes, and the determination of the reasonableness of the rates negotiated by WAPA.

21427 (DOE/PO–0033) **Weathering the cold of '94. A review of the January 1994 energy supply disruptions in the Eastern United States.** Department of Energy, Washington, DC (United States). Office of Strategic Petroleum Reserve. May 1995. 103p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95011786. Source: OSTI; NTIS; GPO Dep.

This report examines the causes of and responses to the very low temperatures over a wide region of the Eastern US causing unprecedented sustained demand for energy during the week of January 16–22, 1994. The topics of the report include the vagaries of the weather, the North American power supply structure, a chronology of major events of January, natural gas industry operations during peak demand periods, and recommendations for fuel supply, load forecasting, and energy emergency response exercises.

21428 (ETDE-DE–133) **Bayernwerk AG. 74th annual report, 1 October 1993 through 30 September 1994.** Bayernwerk AG, Muenchen (Germany). [1995]. 105p. (In German). Order Number DE95785450. Source: OSTI; NTIS (US Sales Only).

The tasks and activities of this German electric utility are presented. The 1993/'94 annual report comprises many financial data (balance sheet, profit-and-loss account, etc.). (UA)

21429 (ORNL/CON–415) **Identification and definition of unbundled electric generation and transmission services.** Kirby, B.; Hirst, E.; Vancoevering, J. Oak Ridge National Lab., TN (United States). Mar 1995. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011625. Source: OSTI; NTIS; GPO Dep.

State and federal regulators, private and public utilities, large and small customers, power brokers and marketers, and others are engaged in major debates about the future structure of the electric industry. Although the outcomes are far from certain, it seems clear that customers will have much greater choices about the electric services they purchase and from whom they buy these services. This report examines the "ancillary" services that are today buried within the typical vertically integrated utility. These ancillary services support and make possible the provision of the basic services of generating capacity, energy supply, and power delivery. These ancillary services include: Management of generating units; reserve generating capacity to follow variations in customer loads, to provide capacity and energy when generating units or transmission lines suddenly fall, to maintain electric-system stability, and to provide local-area security; transmission-system monitoring and control; replacement of real power and energy losses; reactive-power management and voltage regulation; transmission reserves; repair and maintenance of the transmission network; metering, billing, and communications; and assurance of appropriate levels of power quality. Our focus in this report, the first output from a larger Oak Ridge National Laboratory project, is on identification and definition of these services. Later work in this project will examine more closely the costs and pricing options for each service.

21430 (PNL–10567) **Industrial demand side management: A status report.** Hopkins, M.F. (and others); Conger, R.L.; Foley, T.J. Pacific Northwest Lab., Richland, WA (United States). May

1995. 213p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014507. Source: OSTI; NTIS; GPO Dep.

This report provides an overview of and rationale for industrial demand side management (DSM) programs. Benefits and barriers are described, and data from the Manufacturing Energy Consumption Survey are used to estimate potential energy savings in kilowatt hours. The report presents types and examples of programs and explores elements of successful programs. Two in-depth case studies (from Boise Cascade and Eli Lilly and Company) illustrate two types of effective DSM programs. Interviews with staff from state public utility commissions indicate the current thinking about the status and future of industrial DSM programs. A comprehensive bibliography is included, technical assistance programs are listed and described, and a methodology for evaluating potential or actual savings from projects is delineated.

21431 (PNL-SA-26114) **An approach to distribution short-term load forecasting.** Stratton, R.C.; Gaustad, K.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503142--2: Workshop on environmental and energy applications of neural networks conference, Richland, WA (United States), 30-31 Mar 1995). Order Number DE95011418. Source: OSTI; NTIS; GPO Dep.

This paper reports on the developments and findings of the Distribution Short-Term Load Forecaster (DSTLF) research activity. The objective of this research is to develop a distribution short-term load forecasting technology consisting of a forecasting method, development methodology, theories necessary to support required technical components, and the hardware and software tools required to perform the forecast The DSTLF consists of four major components: monitored endpoint load forecaster (MELF), nonmonitored endpoint load forecaster (NELF), topological integration forecaster (TIF), and a dynamic tuner. These components interact to provide short-term forecasts at various points in the, distribution system, eg., feeder, line section, and endpoint. This paper discusses the DSTLF methodology and MELF component MELF, based on artificial neural network technology, predicts distribution endpoint loads for an hour, a day, and a week in advance. Predictions are developed using time, calendar, historical load, and weather data. The overall DSTLF architecture and a prototype MELF module for retail endpoints have been developed. Future work will be focused on refining and extending MELF and developing NELF and TIF capabilities.

2980 Consumption and Utilization

Refer also to citation(s) 20655, 21414, 21425

21432 (DOE/EIA-0035(95/05)) **Monthly energy review, May 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 24 May 1995. 181p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012805. Source: OSTI; NTIS; GPO; GPO Dep.

Energy production during Feb 95 totaled 5.4 quadrillion Btu (Q), 3.1% over Feb 94. Energy consumption totaled 7.4 Q, 0.7% below Feb 94. Net imports of energy totaled 1.3 Q, 5.6% below Feb 94. This publication is divided into energy overview, energy consumption, petroleum, natural gas, oil and gas resource development, coal, electricity, nuclear energy, energy prices, and international energy.

21433 (DOE/EIA-0219(93)) **International energy annual, 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 8 May 1995. 168p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012804. Source: OSTI; NTIS; GPO; GPO Dep.

This document presents an overview of key international energy trends for production, consumption, imports, and exports of primary energy commodities in over 200 countries, dependencies, and areas of special sovereignty. Also included are population and gross domestic product data, as well as prices for crude oil and petroleum products in selected countries. Renewable energy includes hydroelectric, geothermal, solar and wind electric power and alcohol for fuel. The data were largely derived from published sources and reports from US Embassy personnel in foreign posts. EIA also used data from reputable secondary sources, industry reports, etc.

21434 (ETDE-DE-110) **Landeshauptstadt Kiel. News from the building department. Energy report 1991-1992.** Stadt Kiel (Germany). Hochbauamt. [1995]. 30p. (In German). Order Number DE95778070. Source: OSTI; NTIS (US Sales Only).

This annual report discusses the following subjects: Energy consumption and energy cost per annum; Energy prices and water prices in 1992; Distribution of energy types by user groups; Energy consumption per unit area; Savings of electrical energy; Modernisation measures in heating ans sanitary systems; water saving measures; Use of renewable energy sources in municipal swimming pools; Use of alternative energy sources. (orig./UA)

21435 (NEI-DK-2018) **Common trends in energy consumption in nine OECD countries.** Skriftserie C. Institut for Erhvervs- og Samfundsbeskrivelse, 63. Engsted, T.; Bentzen, J. Handelshoejskolen i Aarhus (Denmark). Inst. for Erhvervs- og Samfundsbeskrivelse. Nov 1994. 18p. Order Number DE95779217. Source: OSTI; NTIS.

Bivariate and multivariate co-integration techniques are used to test for common trends in energy consumption, real energy prices, and real income among nine OECD countries during the period 1951-1991. Two main results appear: First, shocks to energy consumption have been common to a number of countries. However, for some countries energy consumption has been mostly driven by country-specific factors. Second, we have found strong evidence that, in addition to real income and real energy prices, one or more non-stationary variables have an impact on energy consumption in the long run. An obvious candidate for this additional variable is energy efficiency (or technological progress). (au) (16 refs.)

21436 (UCRL-ID-18991-93) **California energy flow in 1993.** Borg, I.Y.; Briggs, C.K. Lawrence Livermore National Lab., CA (United States). 1 Apr 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011306. Source: OSTI; NTIS; GPO Dep.

Energy consumption in the state of California decreased about 3% in 1993 reflecting continuation of the recession that was manifest in a moribund construction industry and a high state unemployment that ran counter to national recovery trends. Residential/commercial use decreased slightly reflecting a mild winter in the populous southern portion of the state, a decrease that was offset to some extent by an increase in the state population. Industrial consumption of purchased energy declined substantially as did production of self-generated electricity for in-house use. Consumption in the transportation sector decreased slightly. The amount of power transmitted by the utilities was at 1992 levels; however a smaller proportion was produced by the utilities themselves. Generation of electricity by nonutilities, primarily cogenerators and small power producers, was the largest of any state in the US. The growth in the number of private power producers combined with increased amounts of electricity sold to the public utilities set the stage for the sweeping proposals before the California Public Utility Commission to permit direct sales from the nonutilities to retail customers. California production of both oil and natural gas declined; however, to meet demand only the imports of natural gas increased. A break in the decade-long drought during the 1992--1993 season resulted in a substantial increase in the amount of hydroelectricity generated during the year. Geothermal energy's contribution increased substantially because of the development of new resources by small power producers. Decline in steam production continued at The Geysers, the state's largest field, principally owned and managed by a public utility. Increases in windpower constituted 1--1/2% of the total electric supply--up slightly from 1992. Several solar photo voltaic demonstration plants were in operation, but their contribution remained small.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 21075, 21076, 21134, 21414, 21415, 21436

21437 (NEI-DK–1983) **Progress report on the economy of centralized biogas plants.** Energistyrelsen, Copenhagen (Denmark). Feb 1995. 35p. Order Number DE95779153. Source: OSTI; NTIS.

Public investment grants for the construction of biomass conversion plants producing methane for fuelling Danish cogeneration plants could be reduced, it is stated. Admixing of industrial organic wastes with manure and the use of effluent buffer storage tanks has lead to increased gas production. Transport of liquid manure and returning the digested effluent to the farmers accounts for 35%-50% of total operating costs. The use of top-mounted slow-rotating stirrers have produced positive results. Odour is still a problem in relation to these plants, burning ventilated air seems to be more reliable than using wood chip filters. Gas cleaning by adding ambient air to the biogas was found to be successful. Large, low-pressure, double membrane gas holders built on top of the effluent storage tanks are proved efficient. Transport is most efficiently carried out by using low pressure systems with condensate traps. Municipal solid organic wastes mixed with pig slurry and preheated to 70 degrees centigrade have been used with satisfactory results, plastic residues are separated after digestion to ensure a clean effluent. A gas production of 30-35 m^3 biogas per cubic meter feedstock is a precondition for the economic viability of a centralized biomass conversion plant in Denmark. Goals for future development are drawn up. (AB)

21438 (NEI-DK–2024) **Evaluation of the effectiveness of expenditure on renewable energy technology and the potentials for CO_2 reduction. Report supplementary to Plan of management for renewable energy 1995-97.** Ramboell, Hannemann og Hoejlund A/S, Virum (Denmark). Jan 1995. 73p. (In Danish). Order Number DE95787787. Source: OSTI; NTIS.

Based on a socio-economic comparison of various Danish renewable energy technologies dealt with in the document entitled Plan of Management for Renewable Energy Technologies 1995-97 (Handlingsplan for vedvarende energi 1995-97) produced by a Danish firm for the government, a budget analysis is to be made by the Danish energy Agency for the Ministry of Finance. The analysis (which compares various technology developments which could lead to CO_2 reduction and evaluates renewable energy technologies (RET) in relation to the extra costs for the Danish society connected with the reduction of CO_2) will be used to evaluate how the energy sector can, with the minimum of expense, meet the goals of 20% reduction of CO_2 emission in 2005 (in comparison with 1988 levels). Thus the aim is to analyse a selection of these technological developments related to renewable energy sources and the results will be used as a basis for a governmental plan of management for the development of renewable energy sources. (AB)

21439 (NEI-DK–2025) **Promotion of industry and exports for Danish renewable energy technology. Report supplementary to Plan of Management for Renewable Energy Sources 1995-97.** Ramboell, Hannemann og Hoejlund A/S, Virum (Denmark). Jan 1995. 88p. (In Danish). Order Number DE95787790. Source: OSTI; NTIS.

Danish energy policy gives priority to the reduction of CO_2 and other greenhouse gases which leads to the aim of increasing the use of renewable energy sources and thus widening the market for related technology to include other countries. Suggestions as to how to increase exports and thus achieve this aim are given. The Danish renewable energy branch is described in detail and the regional markets are characterized. Barriers to Danish export increase are identified. Smaller Danish firms would need financial support in order to work together in a form of association, but cooperation should now be initiated also with relation to promotion campaigns. Cooperation is already to be found within the wind turbine industry. The renewable energy sector provides considerable employment and exports within this branch constitute one eighth of total within the energy sector. The biggest market for Danish renewable energy technology (RET) is in Germany and other European Union (EU) member countries. To enter this market requires the instigation by EU of standardization, further development of Danish quality assurance and common quality marking procedures, and an increase in information dissemination, especially with regard to knowledge of EU's financial support programs. Recommendations are also given with reference to markets in east and central Europe, in Russia and in developing and recently industrialized countries. Danish authorities should ensure that Danish RET figures in international conferences etc. which means that representatives of this country should be continually updated on this subject and regulary report back to the domestic RET branch. (AB) (62 refs.)

21440 (NEI-DK–2045) **Suggestion for development programme for bioenergy.** Energistyrelsen, Copenhagen (Denmark). Udvalget for Biomasse til Energiformal. Jan 1995. 139p. (In Danish). Order Number DE95787759. Source: OSTI; NTIS.

Cover title: Bioenergi udviklingsprogram.

From 1992-1994, 89 million kroner have been used by the Danish government for subsidies to research related to biomass fuels, with emphasis laid on the production of methane. Part of these subsidies were given to the development of new technologies for the production of cogenerated electric power and heating, based on the use of wood and straw as fuel. 15 million kroner were used for follow-up programmes. During these 3 years some changes occurred. In 1983 the government demanded that power plants should gradually increase the use of straw and wood at central plants so that by 2000 1.2 million tons of straw and 0.2 million tons of wood chips would be used as fuels in cogeneration plants. Since the use of set-aside in farming was initiated, interest in using these areas for cultivating biomass crops for fuel grew. An interest has also developed in the use of biomass as additives to fuel and in the use of bio-fuels for vehicles. Against this background a new 3-year experimental programme has been drawn up by a governmental committee. The main points of general research strategy are to further the use of straw and wood chips in cogeneration plants, to make district heating plants less pollutive and flexible in the use of other fuels, to develop user-friendly, less pollutive boilers, to encourage independence of the use of industrial wastes that could be used as fuels in biomass conversion plants producing methane (and to encourage the use of household waste sorted at the source for these plants), to continue research on individual biomass conversion methane-producing plants located on farms and on the cultivation of biomass fuels. (AB)

21441 (NEI-DK–2060) **Communal biomass conversion plant. Sandholt - Lyndelse. Pilot project.** Mark, H.S.; Lyhne, P. Hedeselskabet, Viborg (Denmark). May 1995. 69p. (In Danish). Contract ENS-51161-94.0071. Order Number DE95787843. Source: OSTI; NTIS.

The technical, economical and environmental aspects related to the establishment of a communal methane-producing biomass conversion plant at Sandholt - Lyndelse (Denmark) are described in detail. Nine out of 14 involved local authorities have agreed to the idea of supplying household wastes that have been sorted at the source. The plant would be based on the supply of farm animal manures, organic industrial wastes as well as household wastes. It is of importance for the economic security of the plant that there should be a guarantee of a sufficient number of customers willing to purchase the produced methane, and that the price should harmonize with that of other forms of fuel. Sales, supply and production modules are set up. (AB)

21442 (NEI-DK–2061) **Communal biomass conversion plant. Sandholt - Lyndelse. Pilot project. Supplement.** Mark, H.S.; Pedersen, E.M. Hedeselskabet, Viborg (Denmark). May 1995. 45p. (In Danish). Contract ENS-51161-94.0071. Order Number DE95787844. Source: OSTI; NTIS.

The supplement to the document of the same title gives data on budgets, capacity for methane production, standard conditions for the collection of biomass, and the principles for the coordination of gas recovery at the municipal rubbish dumps and the operation of the biomass conversion plant, - all related to the detailed planning process for the establishment of a methane-producing biomass conversion plant in the Sandholt - Lyndelse area in Denmark. Also

included are diagrams illustrating the design principles of the prospective biomass conversion plant. (AB)

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 21393

21443 (DOE/ET/10815–229) **The Magnetohydrodynamics Coal-Fired Flow Facility. Progress report, October 1, 1994–December 31, 1994.** Tennessee Univ., Tullahoma, TN (United States). Space Inst. Jan 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79ET10815. Order Number DE95013083. Source: OSTI; NTIS; GPO Dep.

In this quarterly technical progress report, UTSI reports on the status of a multitask contract to develop the technology for the steam bottoming portion of a MHD Steam Combined Cycle Power Plant. The report describes the facility maintenance and environmental work completed, status of completing technical reports and certain key administrative actions occurring during the quarter. With program resources at a minimum to closeout the MHD program, no further testing occurred during the quarter, but the DOE CFFF facility was maintained in a standby status with winterization, preventive maintenance and repairs accomplished as needed. Plans and preparations progressed for environmental actions needed at the site to investigate and characterize the groundwater and for removal/disposal of asbestos in the cooling tower. Work continued to progress on archiving the results of the MHD program.

21444 (DOE/ET/10815–230) **Magnetohydrodynamics Coal-Fired Flow Facilty. Progress report,January 1, 1995–March 31, 1995.** Tennessee Univ., Tullahoma, TN (United States). Space Inst. May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79ET10815. (UTSI–95-03). Order Number DE95013082. Source: OSTI; NTIS; GPO Dep.

In this quarterly technical progress report, UTSI reports on the status of a multi-task contract to develop the technology for the steam bottoming portion of a MHD Steam Combined Cycle Power Plant. The report describes the facility maintenance and environmental work completed, status of completing technical reports and certain key administrative actions occurring during the quarter. With program resources at a minimum due to closeout the MHD program, no further testing occurred during the quarter, but the DOE CFFF facility was maintained in a standby status, preventive maintenance and repairs accomplished as needed. Plans and actions progressed for environmental actions needed at the site to investigate and characterize the groundwater. The asbestos in the cooling tower was removed and disposed. Work continued on the preparation for archiving the results of the MHD program.

3003 Thermoelectric Generators

Refer also to citation(s) 21209

3005 Fuel Cells

Refer also to citation(s) 21156

21445 (DOE/FE–0335) **Fuel cell systems multi-year program plan, fiscal years 1995 to 2000.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of the Deputy Assistant Secretary for Advanced Research and Special Technologies. [1995]. 41p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013664. Source: OSTI; NTIS; GPO Dep.

Fuel cell power systems are emerging power generation technologies for the efficient, economical and environmentally acceptable production of electricity. In some applications the by-product heat can also be efficiently used in cogeneration. Fuel cells produce electricity through the electrochemical oxidation of a fuel. They can be operated on a variety of fuels, including natural gas, coal gas, land fill gas and renewable fuels. First market entry units are fueled by natural gas. Fuel cells offer the opportunity for a major new manufacturing industry. System studies have shown that fuel cell power plants can be designed with overall system efficiencies in the 50 to 60 percent range (higher heating value basis) (55 to 65 percent on lower heating value basis). Fuel cell power plants are unique in that they offer high efficiency and low emissions even at part-load and in small sizes. Because of their efficiency, fuel cells will help in reducing CO_2 emissions. Additional benefits are the environmentally desirable operating characteristics offered by fuel cells. Because electricity is produced through an electrochemical reaction rather than by combustion, fuel cells generate very little NO_x and are extremely quiet. This combination of operating characteristics and high efficiency make fuel cells attractive for future electric utility applications. On-site industrial and commercial applications where the by-product heat can be utilized are also attractive. The DOE Office of Fossil Energy, the Gas Research Institute (GRI), and the Electric Power Research Institute (EPRI) are cooperatively sponsoring the development of fuel cell systems for applications in the utility, commercial and industrial sectors. Funding of development and demonstration is also provided by fuel cell developers and potential users. This document describes the fuel cell program of the DOE Office of Fossil Energy and its coordination with other fuel cell activities.

21446 (DOE/MC/25169–3095) **Novel solid state proton-conductors based on polymeric non-oxy acids. Final report.** Appleby, A.J. (Texas A and M Univ., College Station, TX (United States). Center for Electrochemical Systems and Hydrogen Research); Srinivasan, S.; Parthasarathy, A.; Gonzalez, E.R.; Desmarteau, D.; Gillette, M.S.; Ghosh, J.K.; Jalan, V.; Desai, M. Texas A and M Univ., College Station, TX (United States). Center for Electrochemical Systems and Hydrogen Research; Clemson Univ., SC (United States). Dept. of Chemistry; ElectroChem, Inc., Woburn, MA (United States). Jan 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25169. Order Number DE95015701. Source: OSTI; NTIS; GPO Dep.

Objectives of this project were to prepare and characterize novel solid state proton-conductors and to evaluate these compounds as fuel cell electrolytes. The thrust was on the synthesis of new proton-conducting "model" and "polymeric" compounds, based on acid functions of the type $(R_fSO_2)_2NH$ and $(R_fSO_2)_2CH_2$ in appropriate fluorinated carbon structures, their physics-chemical characterization (Infra-red, Nuclear Magnetic Resonance, Differential Scanning Calorimetry, and X-ray Diffraction), and is pro. evaluation as candidate fuel cell electrolytes for use at elevated temperatures. This project consisted of four tasks (i) Synthesis of Proton-Conducting Polymer Electrolytes; (ii) Physical and Chemical Characterization of Proton-Conducting Polymer Electrolytes; (iii) Electrochemical Characterization of Proton-Conducting Polymer Electrolytes; and (iv) Evaluation of Proton-Conducting Polymer Electrolytes for Fuel Cells.

21447 (ETDE-DE–79) **Euro-Quebec Hydro-Hydrogen Pilot Project (EQHHPP). Supplementary task program. Final report. Supplement WP330, WP340, WP370, WP430, WP510.** Ludwig-Boelkow-Systemtechnik (LBST), Ottobrunn (Germany); CONOC Continental Contactors GmbH, Hamburg (Germany). Mar 1993. 51p. Sponsored by Commission of the European Communities, Ispra (Italy). Joint Research Centre. Contract CEC-JRC 3723-89-05 PC ISP D/ Amendment No. 1. Order Number DE95780180. Source: OSTI; NTIS (US Sales Only).

This report is an amendment to the final report, which has been submitted in June, 1992, as LBST-report No. 11/92.

The scope of work of the WP covers the "Assessment of realistic prospects of LH_2-usage in civil aviation", in detail: - Operational scenario for western Europe; - LH_2 cost development; - Investigations on a/c design and cryo systems; - Environmental impact of LH_2-aircraft; - Cost estimate; - The way to a LH_2 fuelled aircraft. (orig.)

21448 (ETDE-DE–79, pp. 370.1-370.11) **Additional safety assessment for system components.** Ludwig-Boelkow-Systemtechnik (LBST), Ottobrunn (Germany); CONOC Continental Contactors GmbH, Hamburg (Germany); Germanischer Lloyd, Hamburg (Germany). Mar 1993. 51p. Sponsored by Commission of the European Communities, Ispra (Italy). Joint Research Centre.

Contract CEC-JRC 3723-89-05 PC ISP D/ Amendment No. 1. In *Euro-Quebec Hydro-Hydrogen Pilot Project (EQHHPP). Supplementary task program. Final report. Supplement WP330, WP340, WP370, WP430, WP510.* Order Number DE95780180. Source: OSTI; NTIS (US Sales Only).

This report is an amendment to the final report, which has been submitted in June, 1992, as LBST-report No. 11/92.

"Within the scope of WP 370 of the EQHHPP Supplementary Task, a process engineering layout of the hydrogen supply systems is to be developed and the concept is to be examined under safety aspects. The main objective is to develop a storage concept which is also applicable to other consumers (e.g. Cogeneration Plant Harburg, MBB Finkenwerder). The fuel cell plant of HEW in Hamburg Barmbek is the reference installation for costumers using gaseous hydrogen." Based on the concepts developed in Phase II, "Two different storage system layouts were designed and examined under safety aspects: 1. Conventional store with stationary tanks filled by lorries. 2. Mobile tanks supplied by lorries and serving as stationary tanks within the installation." (orig.)

21449 (ETDE-DE–79, pp. 510.1-510.7) **Experimentation and experimental simulation of hydrogen combustion with air and oxygen in 1kW to 2kW phosphoric acid fuel cells.** Ludwig-Boelkow-Systemtechnik (LBST), Ottobrunn (Germany); CONOC Continental Contactors GmbH, Hamburg (Germany); Zentrum fuer Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart (Germany). Mar 1993. 51p. Sponsored by Commission of the European Communities, Ispra (Italy). Joint Research Centre. Contract CEC-JRC 3723-89-05 PC ISP D/ Amendment No. 1. In *Euro-Quebec Hydro-Hydrogen Pilot Project (EQHHPP). Supplementary task program. Final report. Supplement WP330, WP340, WP370, WP430, WP510.* Order Number DE95780180. Source: OSTI; NTIS (US Sales Only).

This report is an amendment to the final report, which has been submitted in June, 1992, as LBST-report No. 11/92.

"The operation of a 2 kW PAFC of FUJI Electric on hydrogen and the conditions of hydrogen recycling have been investigated theoretically as well as experimentally. A test facility for a 2 kW PAFC was designed and installed. The cell stack was operated at different temperatures, gas compositions, hydrogen and air utilizations. Current-voltage-characteristics of the cell were measured. The electrical cell efficiency as well as the excess heat was calculated with respect to the LHV of the utilized hydrogen. The characteristics were determined measuring cell voltages, flow rates and temperatures of gases and coolant oil. The experiments were made under continuous variation of the allowed current and at stationary current. (orig.)

21450 (LA-UR–95-1359) **Evaluation of the humidification requirements of new proton exchange membranes for fuel cells.** Grot, S.A.; Hedstrom, J.C.; Vanderborgh, N.E. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950412–9: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95012060. Source: OSTI; NTIS; GPO Dep.

Measurements of PEM fuel cell device performance were made with different gas inlet temperatures and relative humidity using a newly-designed test fixture. Significant improvement in device performance was observed when the fuel inlet temperature was increased above the operating temperature of the cell. These measurements were then correlated to a model to describe energy and mass transport processes. Proton exchange membrane (PEM), fuel cells–the focus of this study–use an ion conducting polymer, especially polyperfluorosulfonic acid materials. These polymer materials, when imbibed with water, exhibit solution-like properties, but because the anions are chemically bound to the polymeric structure, the electrolyte is contained. Importantly, product water removal is simplified, as electrolyte dilution is not a concern. However, the proton transport rate is a function of the polymer geometry, which is set, in part, by the polymer water content. Consequently, dynamics of water flow are essential to understand the design of efficient conversion devices.

21451 (LBL–36813) **Thin-film electrolytes for reduced temperature solid oxide fuel cells.** Visco, S.J.; Wang, L.S.; De Souza, S.; De Jonghe, L.C. Lawrence Berkeley Lab., CA (United States). Nov 1994. 13p. Sponsored by Electric Power Research Inst., Palo Alto, CA (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract AC03-76SF00098. (CONF-941144–146: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95011273. Source: OSTI; NTIS; GPO Dep.

Solid oxide fuel cells produce electricity at very high efficiency and have very low to negligible emissions, making them an attractive option for power generation for electric utilities. However, conventional SOFC's are operated at 1000°C or more in order to attain reasonable power density. The high operating temperature of SOFC's leads to complex materials problems which have been difficult to solve in a cost-effective manner. Accordingly, there is much interest in reducing the operating temperature of SOFC's while still maintaining the power densities achieved at high temperatures. There are several approaches to reduced temperature operation including alternative solid electrolytes having higher ionic conductivity than yttria stabilized zirconia, thin solid electrolyte membranes, and improved electrode materials. Given the proven reliability of zirconia-based electrolytes (YSZ) in long-term SOFC tests, the use of stabilized zirconia electrolytes in reduced temperature fuel cells is a logical choice. In order to avoid compromising power density at intermediate temperatures, the thickness of the YSZ electrolyte must be reduced from that in conventional cells (100 to 200 μm) to approximately 4 to 10 μm. There are a number of approaches for depositing thin ceramic films onto porous supports including chemical vapor deposition/electrochemical vapor deposition, sol-gel deposition, sputter deposition, etc. In this paper we describe an inexpensive approach involving the use of colloidal dispersions of polycrystalline electrolyte for depositing 4 to 10 μm electrolyte films onto porous electrode supports in a single deposition step. This technique leads to highly dense, conductive, electrolyte films which exhibit near theoretical open circuit voltages in H_2/air fuel cells. These electrolyte films exhibit bulk ionic conductivity, and may see application in reduced temperature SOFC's, gas separation membranes, and fast response sensors.

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Refer also to citation(s) 21123, 21386, 21412

21452 (AUC-IBT-R–9442) **Air velocity in a room with displacement ventilation.** Nielsen, P.V. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Dec 1994. 13p. (In Danish). Order Number DE95779155. Source: OSTI; NTIS.

High air velocities in a room with displacement ventilation are located close to the floor where the air moves in a thin layer through the occupied zone. The article describes a new design method which makes it possible to calculate the velocity distribution in this area and it is shown that the flow is a stratified flow governed by gravity forces. The articles gives a description of an adjacent zone which can be defined for a wall-mounted diffuser and a number of important details in the diffuser design are also discussed. The flow in rooms with furniture and rooms with short walls and other flow obstacles is discussed at the end of the article. (au)

21453 (CONF-9506184–2) **From fire to ice.** Adcock, P.W. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Society of Women Engineers national meeting; Boston, MA (United States); 27 Jun - 1 jul 1995. Order Number DE95012874. Source: OSTI; NTIS; GPO Dep.

Absorption chillers are heat-operate refrigeration without harmful environmental emissions (CFCs, HCFCS, and HFCS). The machine uses either steam or a gas-fired burner as the energy source and utilizes endothermic evaporation to provide refrigeration to an external process fluid, usually chilled water. In the United States, absorption chillers are used in regions where the cost of electricity is high relative to natural gas. Absorption chillers are also used in

applications where steam is readily available or in areas where seasonal load peaks cause utilities to subsidize gas cooling. This paper will describe the history of absorption, the basic absorption refrigeration cycle and some advanced high efficiency cycles. Practical applications of absorption refrigeration to commercial end uses will also be discussed.

21454 (CRIE-T–93047) **Study on the radiative cooling effect by spectrally selective surfaces.** Onuma, T. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Miyanaga, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). May 1994. 23p. (In Japanese). Order Number DE95787253. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

In countering the heat island phenomena in urban areas, a radiative cooling effect predicting technique has been developed, which aims at the development and evaluation of a radiative cooling unit using spectrally selective surfaces in consideration of the optical characteristics of the atmosphere and of the wavelengths from the radiative surfaces. For the calculation of atmospheric radiation, LOWTRAN 7 is used, and absorption and radiation have been determined for 13 kinds of gasses including H2O, CO2, O2, and NOx, and for their airsols. Heat balance calculation on the radiative surfaces of the radiative cooling units is performed on the presumption that there is no exchange of heat by conduction or convection. The radiator used in the radiative cooling experiment is provided with heat insulating materials for the suppression of heat conduction and with a cover for the suppression of convection. The radiative surfaces are aluminum plates coated with black and white coating materials that are highly radiative in the far-infrared region, and aluminum plates and mirror-surface aluminum plates lined with selectively radiative vinyl fluoride. There is satisfactory agreement between the result of the experiment and the result of calculation, which endorses the validity of this predictive technique. 8 refs., 15 figs., 2 tabs.

21455 (DOE/CE/15606–T3) **Fiber-optic, anti-cycling, high pressure sodium street light control. Final technical progress report.** Blake (F.H.) and Associates, Mill Creek, CA (United States). 1 May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-94CE15606. Order Number DE95011459. Source: OSTI; NTIS; GPO Dep.

This is the Final Technical Progress Report on a project to develop and market a Fiber-Optic Anti-Cycling High Pressure Sodium Street Light Control. The field test units are now being made with a single vertical PC board design and contains a computer-on-a-chip or PROM IC to take the place of the majority of the components previously contained on the upper logic board. This will reduce the final costs of the unit when it is in production and increase the control's flexibility. The authors have finished the soft tooling and have made the 400 plastic cases for the field test units. The new configuration of the cases entails a simplified design of the control shell which will have the lenses cast in place. The shell and base plastics are now finished and in final assembly awaiting the completion of the PC boards.

21456 (DOE/CE/23810–51C) **Investigation into the fractionation of refrigerant blends. Quarterly technical report, October 1–December 31, 1994.** Biancardi, F.R. (United Technologies Research Center, East Hartford, CT (United States)). Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States); United Technologies Research Center, East Hartford, CT (United States). Jan 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. (UTRC-R–94-970566-3). Order Number DE95011236. Source: OSTI; NTIS; GPO Dep.

While the use of refrigerant blends both from analytical predictions and system test results appear to offer certain performance, capacity, design and operational advantages, there are significant possible service and operational issues that are raised by the use of blends. Many of these issues occur due to the fractionation of the blends. Fractionation can result in increased safety hazards if during leakage the more volatile components are flammable, and must be considered in the design of the heat exchanger, expansion valves and other system components. Fractionation can occur during charging of the system or during leakage in selected two-phase components, as well as due to the different miscibility of the blend component refrigerants and the selected compressor lubricant. The objective of this ARTI-sponsored program is to conduct analytical and laboratory tests aimed at understanding these issues, developing approaches or techniques to predict these effects and/or overcome these potential problems, and conveying to the industry safe and reliable approaches.

21457 (DOE/CE/23810–57) **Accelerated test methods for life prediction of hermetic motor insulation systems exposed to alternative refrigerant/lubricant mixtures. Final report.** Ellis, P.F. II (Radian Corp., Austin, TX (United States)); Ferguson, A.F. Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). ©19 Apr 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95013070. Source: OSTI; NTIS; GPO Dep.

In 1992, the Air-Conditioning and Refrigeration Technology Institute, Inc. (ARTI) contracted Radian Corporation to ascertain whether an improved accelerated test method or procedure could be developed that would allow prediction of the life of motor insulation materials used in hermetic motors for air-conditioning and refrigeration equipment operated with alternative refrigerant/lubricant mixtures. Phase 1 of the project, Conceptual Design of an accelerated test method and apparatus, was successfully completed in June 1993. The culmination of that effort was the concept of the Simulated Stator Unit (SSU) test. The objective of the Phase 2 limited proof-of-concept demonstration was to: answer specific engineering/design questions; design and construct an analog control sequencer and supporting apparatus; and conduct limited tests to determine the viability of the SSU test concept. This report reviews the SSU test concept, and describes the results through the conclusion of the proof-of-concept prototype tests in March 1995. The technical design issues inherent in transforming any conceptual design to working equipment have been resolved, and two test systems and controllers have been constructed. Pilot tests and three prototype tests have been completed, concluding the current phase of work. One prototype unit was tested without thermal stress loads. Twice daily insulation property measurements (IPMs) on this unit demonstrated that the insulation property measurements themselves did not degrade the SSU.

21458 (DOE/CE/23810–59A) **Thermophysical properties of HCFC alternatives. Quarterly report, January 1–March 31, 1995.** Haynes, W.M. (National Inst. of Standards and Technology, Boulder, CO (United States). Thermophysics Div.). Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States); National Inst. of Standards and Technology, Boulder, CO (United States). Thermophysics Div. Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95011237. Source: OSTI; NTIS; GPO Dep.

Numerous fluids and fluid mixtures have been identified as promising alternatives to the HCFC refrigerants, but, for many of them, reliable thermodynamic data do not exist. In particular, reliable thermodynamic properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment and to design and optimize equipment to be reliable and energy efficient. The objective of this project is to measure, with high accuracy, selected thermodynamic properties data for, two pure refrigerants and nine refrigerant blends; these data will be used to fit equations of state and other property models which can be used in equipment design. The new data will fill in gaps in the existing data and resolve problems and differences that exist in and between existing data sets. Most of the studied fluids and blends are potential replacements for HCFC-22 and/or R502; in addition, one pure fluid and one blend are potential replacements for CFC-13 in low temperature refrigeration applications.

21459 (DOE/GO–10095-060) **Loose-fill insulations.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009236. Source: OSTI; NTIS; GPO Dep.

FS-140.

Whether you are increasing the insulation levels in your current home or selecting insulation for a new home, choosing the right insulation material can be challenging. Fibrous loose-fill insulations such as cellulose, fiberglass, and rock wool are options you may wish to consider. This publication will introduce you to these materials–what they are, how they are applied, how they compare with each other, and other considerations regarding their use–so that you can decide whether loose fills are right for your home.

21460 (DOE/GO–10095-087) **Thermally activated heat pumps.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004009. Source: OSTI; NTIS; GPO Dep.

This article describes research to develop efficient gas-fired heat pumps heat and cool buildings without CFCs. Space heating and cooling use 46% of all energy consumed in US buildings. Air-conditioning is the single leading cause of peak demand for electricity and is a major user of chlorofluorocarbons (CFCs). Advanced energy conversion technology can save 50% of this energy and eliminate CFCs completely. Besides saving energy, advanced systems substantially reduce emissions of carbon dioxide (a greenhouse gas), sulfur dioxide, and nitrogen oxides, which contribute to smog and acid rain. These emissions result from the burning of fossil fuels used to generate electricity. The Office of Building Technologies (OBT) of the US Department of Energy supports private industry's efforts to improve energy efficiency and increase the use of renewable energy in buildings. To help industry, OBT, through the Oak Ridge National Laboratory, is currently working on thermally activated heat pumps. OBT has selected the following absorption heat pump systems to develop: generator-absorber heat-exchange (GAX) cycle for heating-dominated applications in residential and light commercial buildings; double-condenser-coupled (DCC) cycle for commercial buildings. In addition, OBT is developing computer-aided design software for investigating the absorption cycle.

21461 (ETDE-DE–114) **The new Thermal Insulation Ordinance. Consequences in terms of construction physics and system design.** IVPU Nachrichten, v. 40. Gertis, K. (Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany)). Industrieverband Polyurethan-Hartschaum e.V., Stuttgart (Germany). Apr 1993. 8p. (In German). Order Number DE95780069. Source: OSTI; NTIS (US Sales Only).

The brochure summarizes the main statements of a lecture on the new Thermal Insulation Ordinance and the applications of hard foamed polyurethane. More low-consumption buildings will have to be constructed in the future, but the goal of CO_2 reduction set by the Federal Government will not be achieved unless older buildings will be modified as well. Low-consumption buildings necessitate competent planning, for which there should be financial rewards.

21462 (ETDE-DE–148) **Energy report Frankfurt am Main 1992.** Linder, M. Stadt Frankfurt am Main (Germany). Hochbauamt. 1993. 84p. (In German). Order Number DE95785917. Source: OSTI; NTIS (US Sales Only).

By joining the 'climate association of European cities', Frankfurt has agreed to reduce its CO_2-emissions by 50% by the year 2010. The so-called 'climate offense 1991' was the first regulatory paper to be set up by a community to reach this goal over a long term. This report now represents the present level of the project. Main points are the development of houses with low entropy, the retrofitting of heating systems, water saving measures and energy management. (BWI)

21463 (ILK-B–3/93/1314) **Investigation of ammonia for liquid cooling in the capacity range 5 to 30 kW. Final report.** Hommann, G. Institut fuer Luft- und Kaeltetechnik GmbH, Dresden (Germany). Apr 1992. 18p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 01ZH921B. Order Number DE95786070. Source: OSTI; NTIS (US Sales Only).

Meanwhile numerous alternatives are available for phase out of chlorofluorocarbons (CFC). The search for suitable replacements for CFC is focusing also on some traditional refrigerants such as ammonia. Ammonia is a well-entrenched refrigerant in industrial service. This project deals with the investigation of the expanded use of ammonia for commercial refrigeration (capacity range 5 to 30 kW). A liquid chiller testing plant with a capacity of 20 kW was designed and erected. This plant comprises plate-type heat exchangers and an elektronic expansion valve. Because of missing the plate-type evaporator the present testing results are still incompletely. (orig.). 3 tabs., 1 fig., 10 refs.

21464 (LBL–32420) **Meteorological modeling applications in building energy simulations.** Sailor, D.J.; Akbari, H. Lawrence Berkeley Lab., CA (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920828–31: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE95011269. Source: OSTI; NTIS; GPO Dep.

Researchers use sophisticated computer models to predict building energy use. These models require extensive input data including building characteristics and dimensions, load schedules, and weather data. The typical source for weather data is the weather station at the nearest airport. Specifically, hourly values of ambient air temperature are necessary. The data obtained from local airports, however, may be significantly different from the actual weather experienced by a nearby residential building. Thus, using local airport data when simulating a residential building may yield inaccurate results. Furthermore, researchers interested in evaluating the potential for heat island mitigation schemes (such as urban tree planting programs) to decrease building air-conditioning energy use need a method for modifying the local airport data accordingly.

21465 (LBL–36119) **The use of energy management and control systems to monitor the energy performance of commercial buildings.** Heinemeier, K.E. (Univ. of California, Berkeley, CA (United States). Dept. of Architecture). Lawrence Berkeley Lab., CA (United States). Dec 1994. 197p. Sponsored by USDOE, Washington, DC (United States);Texas A and M Univ., College Station, TX (United States);California Inst. for Energy Efficiency, Berkeley, CA (United States);California Univ., Berkeley, CA (United States). DOE Contract AC03-76SF00098. Order Number DE95012334. Source: OSTI; NTIS; GPO Dep.

Monitored data play a very important part in the implementation and evaluation of energy conservation technologies and programs. However, these data can be expensive to collect, so there is a need for lower-cost alternatives. In many situations, using the computerized Energy Management and Control Systems (EMCSs)–already installed in many buildings–to collect these commercial building performance data has advantages over more conventional methods. This method provides data without installing incremental hardware, and the large amounts of available operational data can be a very rich resource for understanding building performance. This dissertation addresses several of these issues. One specific objective is to describe a monitoring-project planning process that includes definition of objectives, constraints, resources and approaches for the monitoring. The choice of tools is an important part of this process. The dissertation goes on to demonstrate, through eight case studies, that EMCS monitoring is possible, and to identify and categorize the problems and issues that can be encountered. These issues lead to the creation, use, and testing of a set of methods for evaluation of EMCS monitoring, in the form of guidelines. Finally, EMCS monitoring is demonstrated and compared with conventional monitoring more methodically in a detailed case study.

21466 (LBL–36243) **Measurement of bidirectional optical properties of complex shading devices.** Klems, J.H.; Warner, J.L. Lawrence Berkeley Lab., CA (United States). Jan 1995. 21p. Sponsored by USDOE, Washington, DC (United States);American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States). DOE Contract AC03-76SF00098. A bg 87-127. (CONF-950104–9: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) winter meeting and exhibition, Chicago, IL (United States), 28 Jan - 1 feb 1995). Order Number DE95012250. Source: OSTI; NTIS; GPO Dep.

A new method of predicting the solar heat gain through complex fenestration systems involving nonspecular layers such as shades or blinds has been examined in a project jointly sponsored by ASHRAE and DOE. In this method, a scanning radiometer is used to measure the bidirectional radiative transmittance and reflectance of each layer of a fenestration system. The properties of systems containing these layers are then built up computationally from the measured layer properties using a transmission/multiple-reflection calculation. The calculation produces the total directional-hemispherical transmittance of the fenestration system and the layer-by-layer absorptances. These properties are in turn combined with layer-specific measurements of the inward-flowing fractions of absorbed solar energy to produce the overall solar heat gain coefficient. This paper describes the method of measuring the spatially averaged bidirectional optical properties using an automated, large-sample gonioradiometer/photometer, termed a "Scanning Radiometer." Property measurements are presented for one of the most optically complex systems in common use, a venetian blind. These measurements will form the basis for optical system calculations used to test the method of determining performance.

21467 (LBL–36896) **NFRC efforts to develop a residential fenestration annual energy rating methodology.** Crooks, B. (Cardinal IG, Minneapolis, MN (United States)); Larsen, J.; Sullivan, R.; Arasteh, D.; Selkowitz, S. Lawrence Berkeley Lab., CA (United States). Jan 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9506177–1: Window innovations conference, Toronto (Canada), 8-9 Jun 1995). Order Number DE95011282. Source: OSTI; NTIS; GPO Dep.

This paper documents efforts currently being undertaken by the National Fenestration Rating Council's Annual Energy Rating Subcommittee to develop procedures to quantify the energy impacts of fenestration products in typical residential buildings throughout the US. Parallel paths focus on (1) the development of simplified heating and cooling indices and (2) the development of a more detailed methodology to calculate the cost and energy impacts of specific products in a variety of housing types. These procedures are currently under discussion by NFRC's Technical Committee; future efforts will also address commercial buildings.

21468 (LBL–36933) **Simplified numerical description of latent storage characteristics for phase change wallboard.** Feustel, H.E. Lawrence Berkeley Lab., CA (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012758. Source: OSTI; NTIS; GPO Dep.

Cooling of residential California buildings contributes significantly to electrical consumption and peak power demand. Thermal mass can be utilized to reduce the peak-power demand, down-size the cooling systems and/or switch to low-energy cooling sources. Large thermal storage devices have been used in the past to overcome the short-comings of alternative cooling sources or to avoid high demand charges. With the advent of phase change material (PCM) implemented in gypsum board, plaster or other wall-covering material, thermal storage can be part of the building structure even for light-weight buildings. PCMs have two important advantages as storage media: they can offer an order-of-magnitude increase in thermal storage capacity and their discharge is almost isothermal. This allows to store large amounts of energy without significantly changing the temperature of the sheathing. As heat storage takes place in the building part where the loads occur, rather than externally (e.g., ice or chilled water storage), additional transport energy is not needed. To numerically evaluate the latent storage performance of treated wallboard, RADCOOL, a thermal building simulation model based on the finite difference approach, will be used. RADCOOL has been developed in the SPARK environment in order to be compatible with the new family of simulation tools being developed at Lawrence Berkeley Laboratory. As logical statements are difficult to use in SPARK, a continuous function for the specific heat and the enthalpy had to be found. This report covers the development of a simplified description of latent storage characteristics for wallboard treated with phase change material.

21469 (LBL–37024) **Energy Simulation studies in IEA/SHC Task 18 advanced glazing and associated materials for solar and building applications.** Sullivan, R. (Lawrence Berkeley Lab., CA (United States)); Selkowitz, S.; Lyons, P. Lawrence Berkeley Lab., CA (United States). Apr 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9506177–2: Window innovations conference, Toronto (Canada), 8-9 Jun 1995). Order Number DE95012374. Source: OSTI; NTIS; GPO Dep.

Researchers participating in IEA/SHC Task 18 on advanced glazing materials have as their primary objective the development of new innovative glazing products such as high performance glazings, wavelength selective glazings, chromogenic optical switching devices, and light transport mechanisms that will lead to significant energy use reductions and increased comfort in commercial and residential buildings. Part of the Task 18 effort involves evaluation of the energy and comfort performance of these new glazings through the use of various performance analysis simulation tools. Eleven countries (Australia, Denmark, Finland, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United States) are contributing to this multi-year simulation study to better understand the complex heat transfer interactions that determine window performance. Each country has selected particular simulation programs and identified the following items to guide the simulation tasks: (1) geographic locations; (2) building types; (3) window systems and control strategies; and (4) analysis parameters of interest. This paper summarizes the results obtained thus far by several of the research organizations.

21470 (LBL-PUB–758(Rev.3/95)) **From the lab to the marketplace: Making America's buildings more energy efficient.** Lawrence Berkeley Lab., CA (United States). [1995]. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012304. Source: OSTI; NTIS; GPO Dep.

Since the mid 1970s, DOE has invested some $70 million in research and development at Lawrence Berkeley Laboratory (LBL) for development of advanced energy-efficient building technologies, software, and standards. That investment has helped spawn a $2.4-billion U.S. market for key products-energy-efficient lighting and advanced window coatings-and efficiency standards for residential equipment and computerized tools for more efficient building design. By 1993 DOE's initial investment had reduced consumers' energy bills by an estimated $5 billion ($1.3 billion in 1993 alone). By 2015 we estimate that the products of that investment will save consumers $16 billion annually. LBL research partnerships address a host of other building technology issues as well-building technology issues whose economic benefits are less easy to quantify but whose overall worth is equally important. We analyze public policy issues such as the role of efficiency options as a mitigation strategy for global climate change. We develop planning and demand-management methodologies for electric and gas utilities. We identify technologies and analytical methods for improving human comfort and the quality of indoor air. We contribute to the information superhighway. We focus on the special problems and opportunities presented by energy use in the public sector. And we do all these things at the local, national, and international levels. At LBL, we are part of the multi-laboratory, interdisciplinary approach to building technology research supported by DOE's Office of Energy Efficiency and Renewable Energy. We also participate in buildings-related research supported by DOE's Office of Health and Environmental Research, other federal agencies, and industry. This document describes LBL's role within this wider effort.

21471 (NEI-DK–1984) **Identification of the heat dynamics of greenhouses.** Nielsen, B.; Madsen, H. Statens Planteavlsforsoeg, Frederiksberg (Denmark). Afd. for Biometri og Informatik; Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Mathematical and Operations Research. [1995]. 11p. Contract ENS-1213/91-0015. Order Number DE95779157. Source: OSTI; NTIS.

EFP-91.

In order to select an optimal control strategy for the heat input in greenhouses a reasonable description of the heat dynamics is required. This paper describes the identification of a model for the heat dynamics which takes the global radiation, outdoor air temperature and the heat supply as input variables. The model is a lumped parameter model formulated in state space form and in

continuous time. This formulation contains physical interpretable parameters. For the identification, data from experiments conducted in the winter 1992 have been used. Obviously, a greenhouse is a distributed system. However, the fundamental assumption of the lumped parameter system is that the heat capacity is collected at certain nodes of the system. The nodes correspond to the states used in the state space formulation. The state space model is estimated by a maximum likelihood method. Statistical methods as well as physical knowledge are used to validate the model. The results indicate that a third order model gives an appropriate description of the heat dynamics of the considered greenhouse. (au) (12 refs.)

21472 (NEI-DK–1985) **Identification of the heat dynamics of greenhouses: a course on using CTLSM.** Melgaard, H. (The Technical University of Denmark. Institue of Mathematical Statistics and Operations Research, Lyngby (Denmark)); Madsen, H.; Nielsen, B. Statens Planteavlsforsoeg, Frederiksberg (Denmark). Afd. for Biometri og Informatik; Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Mathematical and Operations Research. Oct 1993. 10p. Contract ENS-1213/91-0015. Order Number DE95779158. Source: OSTI; NTIS.

EFP-91.

In order to select an optimal control strategy for the heat input in greenhouses a reasonable description of the heat dynamics of the green house is required. This paper describes the identification of a model for the heat dynamics which takes the global radiation outdoor air temperature and the heat supply as input variables. The model is a lumped parameter model formulated in state space form and in continuous time. This formulation allows directly physical interpretable parameters. For the identification, data from experiments conducted in the winter 1991 and winter 1992 are used. At the same time the steps involved in the identification serves as a course in using the software tool CTLSM for parameter estimation. The case discussed here is presented and more elaborated in the paper. (au)

21473 (NEI-DK–1986) **Heat flow models for use in modelling. The temperature in greenhouses.** Nielsen, B. Statens Planteavlsforsoeg, Frederiksberg (Denmark). Afd. for Biometri og Informatik. Dec 1993. 29p. (In Danish). Contract ENS-1213/91-0015. Order Number DE95779159. Source: OSTI; NTIS.

EFP-91.

Mathematical models are given in relation to using registered data from a greenhouse to predict how temperature and humidity will develop within the following 1 -2 hours. By comparing the predicted data with the required values for temperature and humidity and using results for the regulation of the temperature inside the greenhouse, a considerable amount of energy can be saved, especially in relation to sudden changes in outside weather. The mathematical models must describe the dynamic aspect of heating conditions in the greenhouse. (AB)

21474 (NEI-DK–1998) **Identification of thermal parameters of greenhouses.** Dina Research Report, 9. Nielsen, B. (The Danish Institute of Plant and Soil Science. Dept. of Biometry and Informatics (Denmark)); Madsen, H. Statens Planteavlsforsoeg, Frederiksberg (Denmark). Afd. for Biometri og Informatik. Nov 1992. 20p. Contract ENS-1213/91-0015. Order Number DE95779160. Source: OSTI; NTIS.

EFP-91. Presented at: International conference on agricultural engineering, Uppsala, Sweden 1992.

An experiment was conducted at The Department of Horticultural Engineering in January and February 1991 with the purpose of identifying thermal parameters of greenhouses. Climate and energy parameters were sampled very second minute. In order to decorrelate solar heating and heating from the heating system, the latter was controlled by a Pseudo Random Binary Signal (PRBS). Data was sampled from 2 periods: one period of 3 days (28-30 Jan.) and one period of 4 days (7-10 Feb.). A spectral density analysis on data shows predominance of low frequencies with periods larger then 20 minutes. For each period, a Box-Jenkins transfer function model was identified. The order of all models was less than three and an agreement between the two periods was observed for the heat transmission coefficients. For both periods a third order model was found and estimated. A short time-constant of about 4.4 to 5.5 minutes and a longer time-constant of about 20 to 30 minutes were observed. The purpose of estimating these transfer function models is to let models form the basis for an improved strategy of the energy supply. (au) (12 refs.)

21475 (ORNL/CON–410) **Science and technology for a sustainable energy future: Accomplishments of the Energy Efficiency and Renewable Energy Program at Oak Ridge National Laboratory.** Brown, M.A.; Vaughan, K.H. Oak Ridge National Lab., TN (United States). Mar 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012536. Source: OSTI; NTIS; GPO Dep.

Accomplishments of the Energy Efficiency and Renewable Energy Program at the Oak Ridge National Laboratory are presented. Included are activities performed in the utilities, transportation, industrial, and buildings technology areas.

21476 (PNL–9065-Vol.1) **Fort Irwin National Training Center integrated resource assessment. Volume 1: Executive summary.** Keller, J.M.; Richman, E.E.; Stucky, D.J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013852. Source: OSTI; NTIS; GPO Dep.

Some of the most difficult problems encountered at federal sites in reducing energy consumption in a cost-effective manner revolve around understanding where energy is being used and what technologies can be employed to decrease energy use. Many large federal sites have one or two meters to track electric energy use for several thousand buildings and numerous industrial processes. Even where meters are available on individual buildings or family housing units, the meters are not consistently read. When the federal energy manager has been able to identify high energy users, the energy manager may not have the background, training, or resources to determine the most cost-effective options for reducing this energy use. This limitation can lead to selection of suboptimal projects that prevent the site from achieving full life-cycle cost savings. The U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP) has been tasked by the U.S. Army Forces Command (FORSCOM) to identify, evaluate, and acquire all cost-effective energy projects at selected federal facilities. Pacific Northwest Laboratory (PNL) is assisting FEMP in this effort. This is part of a model program that PNL has developed to provide a systematic approach to evaluating energy opportunities. The program (1) identifies the building groups and end uses using the most energy (not just having the greatest energy-use intensity), and (2) evaluates the numerous options for retrofit or installation of new technology that will result in the selection of the most cost-effective technologies. In essence, this model program provides the federal energy manager with a road map to significantly reduce energy use in a planned, rational, cost-effective fashion that is not biased by the constraints of the typical funding sources available to federal sites.

21477 (PNL–9820-Rev.1) **Energy efficiency assessment methods and tools evaluation. Bolling Air Force Base. Revision 1.** McMordie, K.L.; Richman, E.E.; Keller, J.M.; Dixon, D.R. Pacific Northwest Lab., Richland, WA (United States). May 1995. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012765. Source: OSTI; NTIS; GPO Dep.

The goal of the U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP) is to facilitate energy-efficiency improvements at federal facilities. This is accomplished by a balanced program of technology development, facility assessment, and use of cost-sharing procurement mechanisms. Technology development focuses upon the tools, software, and procedures used to identify and evaluate energy-efficiency technologies and improvements. For facility assessment, FEMP provides metering equipment and trained analysts to federal agencies exhibiting a commitment to improve energy use efficiency. To assist in procurement of energy-efficiency measures, FEMP helps federal agencies devise and implement performance contracting and utility demand-side management strategies. Pacific Northwest Laboratory (PNL) supports the FEMP mission of energy systems modernization. Under this charter, the Laboratory and its contractors work with

federal facility energy managers to assess and implement energy-efficiency improvements at federal facilities nationwide.

21478 (SBI-MEDD–108) **Energy and environmental analyses of buildings. Examples.** Nielsen, P. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1995. 29p. (In Danish). Contract ENS-1213/92-0011. Order Number DE95787729. Source: OSTI; NTIS.

EFP-92.

The Danish Building Research Institute has developed a model and a spreadsheet program for calculating the total energy consumption of buildings and their energy-related emissions of CO_2 and SO_2. This was used for analyses of 22 buildings. Total energy consumption for construction, operation and disposal, together with the energy-related emissions of CO_2 and SO_2 during the entire life cycle of the building, was calculated for 4 single-family houses and one apartment building, comprising houses of today's standard, low-energy houses and an experimental house (Villa Vision). Analyses and comparisons were carried out on the total energy consumption for construction and the net energy consumption for heating and ventilation. Energy consumption for construction and the total quantities of building goods were calculated for 22 buildings, including the 5 mentioned above. The buildings comprise housing, agricultural, industrial, institutional, and office buildings. An analysis was made to show total variation in the result of the calculation in relation to the future reuse and the energy source in question. Energy consumption for construction is ca. 5% of the total for housing. For low-energy houses it is ca. 20%, and for Villa Vision, ca. 60%. Energy consumption for construction of buildings built in accordance with 1982 Building Regulations amounts to 13-23% of the energy consumption. For low-energy houses, it is 75%, and for Villa Vision, it is 40% greater than net energy consumption. Energy consumption for construction is highest for houses and office buildings, and lowest for agricultural buildings. (AB) 18 refs.

21479 (SBI-R–242) **Energy and architecture - a collection of examples of newer buildings.** Aggerholm, S.; Svensson, O. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1995. 73p. (In Danish). Order Number DE95787774. Source: OSTI; NTIS.

A collection of examples of newer Danish buildings wherein special attention has been given to energy conservation combined with high quality architecture. Included are recently erected residential commercial, institutional and also retrofitted buildings. The aim has been to inspire architects and engineers to devote themselves to a higher degree to the inclusion of the concept of energy conservation in buildings. (AB) 17 refs.

3202 Transportation

Refer also to citation(s) 21475, 22204, 22208

21480 (BNL–52464) **Traffic congestion forecasting model for the INFORM System. Final report.** Azarm, A.; Mughabghab, S.; Stock, D. Brookhaven National Lab., Upton, NY (United States). May 1995. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012251. Source: OSTI; NTIS; GPO Dep.

This report describes a computerized traffic forecasting model, developed by Brookhaven National Laboratory (BNL) for a portion of the Long Island INFORM Traffic Corridor. The model has gone through a testing phase, and currently is able to make accurate traffic predictions up to one hour forward in time. The model will eventually take on-line traffic data from the INFORM system roadway sensors and make projections as to future traffic patterns, thus allowing operators at the New York State Department of Transportation (D.O.T.) INFORM Traffic Management Center to more optimally manage traffic. It can also form the basis of a travel information system. The BNL computer model developed for this project is called ATOP for Advanced Traffic Occupancy Prediction. The various modules of the ATOP computer code are currently written in Fortran and run on PC computers (pentium machine) faster than real time for the section of the INFORM corridor under study. The following summarizes the various routines currently contained in the ATOP code: Statistical forecasting of traffic flow and occupancy using historical data for similar days and time (long term knowledge), and the recent information from the past hour (short term knowledge). Estimation of the empirical relationships between traffic flow and occupancy using long and short term information. Mechanistic interpolation using macroscopic traffic models and based on the traffic flow and occupancy forecasted (item-1), and the empirical relationships (item-2) for the specific highway configuration at the time of simulation (construction, lane closure, etc.). Statistical routine for detection and classification of anomalies and their impact on the highway capacity which are fed back to previous items.

21481 (DOE/GO–10095-171) **Beating the traffic with commuting alternatives.** National Renewable Energy Lab., Golden, CO (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94006858. Source: OSTI; NTIS; GPO Dep.

This pamphlet describes how, by encouraging commuting options, local governments can help reduce air pollution, fuel consumption, and traffic congestion. Minimizing these problems makes the community more appealing to businesses, residents, and visitors and boosts the local economy. Approaches to alternative transportation are as varied as the communities devising and using them. But the critical factor is initiative from local governments, often one of communities largest employers. They can use and promote commuting alternatives among their employees. Local governments can also promote alternative transportation among other employers and the general public. They can provide information on commuting options, improve the infrastructure, and use local authority to require and reward those changes necessary to make alternative transportation a widely accepted part of community life. Best of all, local governments can lead by example and establish a template for other employers to follow.

21482 (NEI-DK–2026, pp. 43-52) **Truck and sustainable transport - cargo- and personal transport.** Joergensen, K. (Danmarks Tekniske Univ., Fysisk Inst., Energrigruppen, Lyngby (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). Contract ENS-1753/92-0004. (CONF-9408240–Vol.1: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 1.* 223p. Order Number DE95787784. Source: OSTI; NTIS.

The part of truck transport in the Danish transportation system is described. Mechanisms of truck expansion and its consequences are summarized. The trucks represent a major share of the total fuel consumption and noxious emissions in Denmark. Sustainable transportation development depends on changes in the use of too powerful truck engines and a more efficient design. (EG) (15 refs.)

21483 (NEI-DK–2027, pp. 377-387) **Truck transport and a better environment.** Holm, O. (Danske Vognmaend (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS.

Use of trucks to transport freight can be more efficient, if engine technology and fuel quality is improved, trucks have bigger capacity, planning of routes and driving skills are improved. (EG)

21484 (NEI-DK–2027, pp. 389-392) **Reduction in the energy consumption from goods transport in Odense.** Dorn-Jensen, H. (Anders Nyvig A/S (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS.

In most Danish cities we experience problems with the distribution of goods in the city centre. On the one hand the environment suffers from the impact of heavy lorries, and on the other hand the distributors have great difficulty in bringing goods to the city, because of traffic congestions and restrictions on the heavy traffic, enforced by the municipality. Since the traffic density in Danish cities is steadily growing, there will be increasing need for solutions of the problems. The municipality of Odense has initiated a project,

in which the problems will be analysed in search for future solutions. In 1993 the Commission of the European Union granted support to the project within the framework of the SAVE Programme. The Danish Transport Council, which is established by the Danish government, is furthermore giving support to the project. Odense is the third largest town in Denmark with approximately 170.000 inhabitants. (au)

21485 (NEI-DK–2048) **Cars, energy consumption and safety.** Skriftserie. Institut for Samfundsudvikling og Planlaegning. AUC, 111. Vibe-Petersen, J. Aalborg Universitetscenter (Denmark). Inst. for Samfundsudvikling og Planlaegning. Jun 1993. 220p. (In Danish). Order Number DE95787752. Source: OSTI; NTIS.

A detailed discussion of the threat to the environment of pollutive exhaust gases, noise pollution and the risk of accidents, caused by the continued increase in the use of automobiles. Conflicts in points of view of how to address this dilemma are described and it is debated to what extent energy conservation and environmental protection are compatible with the need to reduce the number of people injured as the result of traffic accidents. It is suggested that significant energy savings must be based on the use of lighter cars with smaller motors and that this does not mean that the standard of safety would be lowered. It is claimed that lightweight cars are involved in fewer accidents resulting in human injury, but passengers and drivers are less protected in the case of collisions with heavier vehicles. This problem could be solved by reducing the amount of heavy vehicles on the road. Raising safety standards will necessarily involve stricter demands on the part of the authorities in respect to the authorization of car types and the introduction of further safety safety standards and equipment. (AB)

21486 (NEI-DK–2050) **Ferry services over the Kattegat.** Trafikministeriet, Copenhagen (Denmark). 1995. 78p. (In Danish). Order Number DE95787757. Source: OSTI; NTIS.

In connection with the building of a bridge over the Great Belt (the waterway between the islands of Funen and Zealand in Denmark) the question of the future ferry services over the Kattegat strait had to be evaluated in the light of the introduction of new types of ferries for this service. The Ministry of Transport set up a working group to discuss the development of new types of ferry, the economic potentials for continuing the freight route with limited passenger capacity that runs between Kalundborg and Aarhus, possibilities for transporting trailers by ferry during the night, and the relation between developments of future routes and the traffic system on land - including an evaluation of the road network which leads to the ferry ports. The working group also evaluated environmental aspects of the development of the ferry services over the Kattegat. The results of these deliberations are presented. Attention is given to the pollution caused by ferries. (AB)

21487 (TKK-KO/AT–1994/1) **Vehicle navigation systems as a means to reduce energy use in transportation.** Karppinen, A. Helsinki Univ. of Technology, Otaniemi (Finland). Automotive Engineering. 1994. 83p. Project KTM-MOBILE 201T. Order Number DE95779246. Source: OSTI; NTIS.

MOBILE Research Programme.

The goal of this study is to establish the basis for the assessment of the potential of vehicle navigation systems as a tool to gain a reduction in traffic energy consumption. The most promising functions of the in-vehicle systems in this respect are navigation and route guidance. Dynamic traffic management realised with modern traffic information systems and working in parallel with the dynamic route guidance systems seems to have the highest potential in the task of reducing traffic energy consumption. In the study, the fundamental ideas of vehicle navigation are discussed. Then the categorisation of Road Vehicle Communication (RVC) systems and the relevant functions of in-vehicle systems are presented as the basis for descripting various systems. Traffic assignment models are an indispensable instrument in the assessment of vehicle navigation systems in the context on energy saving. Some of the recent models are discussed briefly. Future work will concentrate on a small scale field experiment in the greater Helsinki area and the development and exploitation of a dynamic traffic assignment model to evaluate the possible energy savings in the test area.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 20536, 20577, 20578, 20646, 20722, 20825, 21073, 21074, 21393, 21430, 21577, 21590, 21602, 22124, 22199, 22247, 22372

21488 (ANL/ESD/TM–80) **Utilization of surface-treated rubber particles from waste tires.** Smith, F.G. (Argonne National Lab., IL (United States). Energy Systems Div.). Argonne National Lab., IL (United States). Dec 1994. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012093. Source: OSTI; NTIS; GPO Dep.

During a 12-month program, the author successfully demonstrated commercial applications for surface-treated rubber particles in two major markets: footwear (shoe soles and components) and urethane-foam carpet underlay (padding). In these markets, he has clearly demonstrated the ease of using R-4080 and R-4030 surface-treated rubber particles in existing manufacturing plants and processes and have shown that the material meets or exceeds existing standards for performance, quality, and cost-effectiveness. To produce R-4080 and R-4030, vulcanized rubber, whole-tire material is finely ground to particles of nominal 80 and mesh size respectively. Surface treatment is achieved by reacting these rubber particles with chlorine gas. In this report, the author describes the actual test and evaluations of the participant companies, and identifies other potential end uses.

21489 (ANL/TD/CP–85711) **The choice: Welding with CO_2 or Nd:YAG lasers.** Leong, K.H. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503113–2: Automotive laser applications workshop, Dearborn, MI (United States), 6-7 Mar 1995). Order Number DE95011825. Source: OSTI; NTIS; GPO Dep.

The recent commercial availability of multi-kilowatt Nd:YAG lasers has opened new avenues for rapid laser processing as well as intensified the competition (cost effectiveness) between CO_2 and Nd:YAG laser systems. Vendors offering Nd:YAG laser systems may claim lower operating costs (than CO_2) and fiberoptic beam delivery flexibility while CO_2 systems vendors may emphasize lower capital cost and well established processing requirements and experience. The capital and operating costs of a laser system are impacted by demand and supply economics and technological advances. Frequently the total cost of a workcell using a laser for processing has to be considered rather than the laser system alone. Consequently it is not very practical to approach the selection of a laser system based on its capital cost and estimated operating cost only. This presentation describes a more pragmatic approach to aid the user in the selection of the optimal multi-kilowatt laser system for a particular processing requirement with emphasis on welding. CO_2 laser systems are well established on the factory floor. Consequently, emphasis is given to the comparative application of Nd:YAG lasers, process requirements and performance. Requirements for the laser welding of different metals are examined in the context of hardware (laser system and beam delivery) selection and examples of welding speeds that can be achieved using CO_2 and Nd:YAG lasers are examined.

21490 (CRIE-R–93007) **Fundamental study of signal processing by optics. Part 3. Non distortion transmission of 2D-information in a fiber using an optical phase conjugator.** Kuribara, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Kurono, M.; Isawa, K. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1994. 32p. (In Japanese). Order Number DE95787254. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

For realizing a non-distortion transmission of 2D-information in an optical fiber, an experimental study has been undertaken concerning the compensation by a phase conjugate wave for the impact of modes generated in an optical fiber. As for the experimental devices, a crystal of BaTiO3 and BSO is used in case of degenerate four light wave mixing and a BaTiO3 crystal in case of self-excitation. The light source is an argon ion laser of a 0.5145-micron wavelength, and the optical fibers are of the SI type, 200/

230 and 400/550 microns in core clad diameter and 0.5 and 1 meter in length, polished obliquely at an angle of 8 degrees. The result of the experiment reveals that the wave surface after emission through the optical fiber assumes a speckled pattern due to optical fiber excited inter-mode interference. The result also shows, however, that the mode distortion is compensated for by the phase conjugate wave both in case of four optical wave mixing and of self-excitation. Further, for the generation of the phase conjugate wave, the spectral width of the light source needs to be approximately several MHz to several tens MHz. 14 refs., 19 figs., 1 tab.

21491 (CRIE-U–94018) **Design and operation of seawater recirculation fish culture system for Japanese flounder.** Honda, H. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Kikuchi, K.; Watanabe, Y.; Iwata, N.; Takeda, S.; Uemoto, H.; Furuta, T.; Kiyono, M. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Aug 1994. 33p. (In Japanese). Order Number DE95787252. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

For developing a recirculation fish culture system for Japanese flounder, a pilot system of $20m^3$ of water was designed and constructed, and a verification test was conducted. The system comprises an FRP-made breeding tank, 6m in internal diameter and 1.15m in height, a nitrification tank, a pump, a heat pump using air as the heat source, a UV germicidal unit, a denitrification tank, etc. The verification test revealed that flounder seeds the average body weight 5g grew up to a marketable weight of 500g in approximately 10 months. Thanks to the water purifying nitrification tank the concentration of ammonia and nitrous acid was kept at not more than 1mg per liter. The denitrification tank also functioned satisfactorily for the removal of nitric acid from the breeding water. The quantity of seawater per flounder produced was 1/2000 of the quantity required by the conventional method wherein seawater continuously flows. A tentative calculation of the running cost indicates that, with 12 of the system of this design in use, a total cost of 1000 to 1100 yen per year was required, the said total cost covering the seeds, feed, and electric power, for the production of 1kg of flounder, which sum is approximately equal to what is needed in the conventional method. 36 refs., 7 figs., 3 tabs.

21492 (DOE/CE/15602–T2) **[Replacement of thermally produced calcined clay with chemically structural pigments]. Quarterly technical report, April 1, 1995–June 30, 1995.** Whalen-Shaw, M. Whalen-Shaw (Michael), Circleville, OH (United States). 30 Jun 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC01-94CE15602. Order Number DE95014913. Source: OSTI; NTIS; GPO Dep.

Subject is coating of paperboard. Structured pigments designed to eliminate calcined clay were prepared and tested. Focus was on brown kraft and recycled paperboard which use 5–15% calcined clay with 20% TiO_2, the rest of the pigment being standard clay. Several structured (layered) pigments were compared to show brightness improvement after coating. The composite pigment formed with TiO_2 and EZ clay gave both excellent brightness and higher gloss. An attempt was made to make a structured pigment with cationic latex and standard clay that would replace a calcined clay-standard clay blend, for precoating paperboard.

21493 (DOE/CE/40006–T1) **Commercialization of on-machine sensors to measure paper mechanical properties. Final report.** Hall, M.S.; Brodeur, P.H.; Jackson, T.G. Institute of Paper Science and Technology, Atlanta, GA (United States). Sep 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC05-93CE40006. Order Number DE95010952. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to develop sensors capable of measuring the velocity of ultrasound in the thickness and in-plane directions of a moving paper web as it is being produced on the paper machine. The velocity of ultrasound can be used to determine various mechanical properties of paper, e.g., the square of the velocity times the basis weight is a measure of the extensional stiffness. On-machine measurements would allow continuous monitoring of product quality as well as provide data for controlling the papermaking process. This report summarizes work supported by Cooperative Agreement No. DE-FC05-93CE40006, USDOE, and by the member companies of the Institute of Paper Science and Technology (IPST). The central purpose of this grant, effective from October 1, 1993 through June 30, 1994, was to establish a plan: to develop a commercially viable system for on-machine, out-of-plane, and in-plane measurements of ultrasonic velocities; install a working system on a paper machine in a host paper mill; demonstrate the system's capabilities and benefits to the paper manufacturing industry; and have a vendor committed to providing and supporting the system. This report first presents a review of the background and potential benefits of on-line ultrasonic velocity measurements. Then the results of the work supported by the previous contract are summarized followed by additional measurements on moving webs in the laboratory. Out-of-plane (ZD) and in-plane ultrasonic velocity data for 26-lb medium and 42-lb liner samples are presented and discussed, illustrating the type of data that will be available from on-machine measurements. Finally, the status of the plans and support for continued work toward commercialization is reviewed.

21494 (DOE/GO–10095-170) **Technology partnerships: Enhancing the competitiveness, efficiency, and environmental quality of American industry.** National Renewable Energy Lab., Golden, CO (United States). Apr 1995. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004086. Source: OSTI; NTIS; GPO Dep.

An overview of the Department of Energy's Office of Industrial Technologies and its private sector partnerships is presented. Commercial success stories and real-world benefits of the technology partnerships are discussed.

21495 (DOE/ID/12911–1) **Rapid Glass Refiner Development Program, Final report.** Vortec Corp., Collegeville, PA (United States). 20 Feb 1995. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-90ID12911. Order Number DE95013072. Source: OSTI; NTIS; GPO Dep.

A rapid glass refiner (RGR) technology which could be applied to both conventional and advanced class melting systems would significantly enhance the productivity and the competitiveness of the glass industry in the United States. Therefore, Vortec Corporation, with the support of the US Department of Energy (US DOE) under Cooperative Agreement No. DE-FC07-90ID12911, conducted a research and development program for a unique and innovative approach to rapid glass refining. To provide focus for this research effort, container glass was the primary target from among the principal glass types based on its market size and potential for significant energy savings. Container glass products represent the largest segment of the total glass industry accounting for 60% of the tonnage produced and over 40% of the annual energy consumption of 232 trillion Btu/yr. Projections of energy consumption and the market penetration of advanced melting and fining into the container glass industry yield a potential energy savings of 7.9 trillion Btu/yr by the year 2020.

21496 (ETDE-DE–144) **Appropriate technologies - utilization of hydrodynamic power.** Aus der Praxis: Landesamt fuer Entwicklungszusammenarbeit. Senator fuer Hafen, Schiffahrt und Aussenhandel, Bremen (Germany). Landesamt fuer Entwicklungszusammenarbeit. 1993. 24p. (In German). Order Number DE95785918. Source: OSTI; NTIS (US Sales Only).

Within the framework of a demonstration project China was provided with thirty hydraulic rams from India for irrigation of a farming area of ca. 60 ha in the mountains. Different irrigation methods suited for developing countries are introduced placing emphasis on descriptions of the hydraulic ram. (BWI)

21497 (FEMP–2347) **Beneficial reuse of US DOE Radioactive scrap metal.** Motl, G.P. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). 19 Jan 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC24-92OR21972. (CONF-950917–8: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95007826. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has more than 2.5 million tons of radioactive scrap metal (RSM) that is either in inventory or expected to be generated over the next 25 years as major facilities

within the weapons complex are decommissioned. Since much of this metal cannot be decontaminated easily, past practice has been to either retain this material in inventory or ship it to DOE disposal sites for burial. In an attempt to conserve natural resources and to avoid burial of this material at DOE disposal sites, options are now being explored to "beneficially reuse" this material. Under the beneficial reuse concept, RSM that cannot be decontaminated and free released is used in applications where the inherent contamination is not a detriment to its end use. This paper describes initiatives currently in progress in the United States that support the DOE beneficial reuse concept.

21498 (KCP–613-5632) **Adhesive materials and processing selection for environmentally conscious manufacturing.** Tira, J.S. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jun 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9507133–1: Planning for a responsible 21st century, Boston, MA (United States), 30 Jul - 2 aug 1995). Order Number DE95013484. Source: OSTI; NTIS; GPO Dep.

Manufacturers that use certain adhesives and related manufacturing processes must consider the impact they have on worker health, safety, and the environment. Product manufacturers must find alternate replacements for solvent-based adhesives and solvent cements. In addition, processes that use ozone-depleting solvents for hand-wipe cleaning operations as well as vapor degreasing must find suitable alternates in order to be environmentally compliant. Likewise, manufacturers that use etching solutions that contain chrome must find a replacement. This paper identifies some of the specific problems associated with using certain adhesives and manufacturing processes. Environmentally acceptable alternative adhesives and processes are presented.

21499 (LUTMDN-TMVK–5248) **A technical and economic feasibility study of cogeneration of heat and power in a Thai textile company. Minor Field Study 1994:48/49.** Sjoestedt, J.; Aakesson, J.Aa. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Mar 1995. 70p. Order Number DE95779302. Source: OSTI; NTIS; INIS.

Examination paper.

This feasibility study deals with cogeneration of heat and power in a textile company. The study was undertaken as a Minor Field Study in Bangkok, Thailand. The gas turbine and the gas engine are identified as the most suitable techniques, due to low initial investment cost, high reliability and high power to heat ratio. An alternative with a gas turbine and double-effect absorption chiller shows the best profitability and a very high EUF, 0.82. The NPV of this investment is 364 million Baht corresponding to an IRR of 41.52% The gas engine alternative generates approximately the same profitability, but the EUF is lower. The gas engine will become even more attractive if some of the steam can be replaced by hot water in the process. To sum up: Both alternatives are technically feasible and the profitability is so high that a more thorough detail study should be undertaken. 30 refs, 19 figs, 22 tabs

21500 (NEI-DK–1995) **Branch analysis of energy for foundries. Supplementary report.** Ravn, O. (DTI, Energi (Denmark)); Olsen, H.; Crepaz, R.; Togeby, M. Dansk Teknologisk Inst., Taastrup (Denmark). Energiteknologi. Aug 1994. 69p. (In Danish). Order Number DE95779151. Source: OSTI; NTIS.

This report, a supplement to the main report entitled 'Branch analysis of energy for the Danish foundry industry' gives details of the energy analysis with regard to the individual foundries examined. (AB)

21501 (NEI-DK–2007) **Efficient public transport in rural and low density urban areas.** Energy Centre Denmark, Copenhagen (Denmark). [1995]. 56p. (In English, French, German). Order Number DE95779201. Source: OSTI; NTIS.

All European countries have large areas characterized by low population density, where agriculture and small-scale industry often play a predominant role. Here transport services are often restricted and this can affect the quality of life of the local inhabitants, so that an infrastructure and public transport system that can compete with motor car flexibility is required. The aim of the publication is to propose solutions to the lack of public transport in low population density areas, and these solutions should take socio-economic, environmental and energy saving considerations into consideration. Some of the solutions offered are the use of multi-purpose vehicles, transport coordination, removal of organizational barriers, the use of computer and communication technology and methods of decreasing energy consumption within the field of transportation. Motives for the development of public transport are also dealt with. (AB)

21502 (NEI-DK–2035) **Branch analysis of energy for foundries. Main report.** Ravn, O. (DTI, Energi (Denmark)); Olsen, H.; Crepaz, R.; Togeby, M. Dansk Teknologisk Inst., Taastrup (Denmark). Energiteknologi. Aug 1994. 94p. (In Danish). Order Number DE95787768. Source: OSTI; NTIS.

Branch energy analysis has been accomplished for the Danish Foundry Branch Association, assisted by the Energy Agency. The period covered is September 1993 - May 1994. 6 foundries considered to be representative for the branch were analyzed in detail. The most profitable possibilities of energy saving measures were localized. Investigation of the energy requiring processes proved that energy consumption of a foundry is primarily concentrated in 3 areas, consuming about 80 % of the total energy consumption. These three areas are casting, ventilation and pressurized gases. The 6 surveyed foundries can save energy corresponding to ca. 30 mln kWh. Energy consumption is distributed over electric power (roughly 65 %), gas (roughly 20 %), oil (roughly 11 %), district heating (4 %). The large saving potentials are to be released by: covering the melters, covering with built-in gas burner to heat the foundry ladles, recovering heat from the cooling water from melters and compressors, reducing the pressure drop above the filter and optimizing the exhaust system etc. (EG) 41 refs.

21503 (NEI-DK–2042) **Energy consumption in relation to industrial products and processes. Results of projects.** Business Consultants ApS, Frederiksberg (Denmark). Jan 1995. 41p. (In Danish). Order Number DE95787800. Source: OSTI; NTIS.

The aim of investigating recent research results connected to energy conservation within industry was to discover whether this area of research carried out under the auspices of the Danish Ministry of Energy radically contributed to the overall energy-saving goals and whether the methods of information dissemination to the industrial sector and the usage of the research results by the industrial sector have been satisfactory. 41 research projects, of which 33 are concluded, are described. It is generally concluded that good results have been achieved, although a little more flexibility could be wished for. The research results have had some significance in relation to energy conservation measures within industry. Special attention must continually be given to process optimization and efforts to further expand and coordinate have already been initiated. (AB)

21504 (PNL–9466) **Impact evaluation of a slush stock chest bypass installed at Scott Paper Company under the energy $avings plan.** Oens, M.A.; Spanner, G.E. Pacific Northwest Lab., Richland, WA (United States). Feb 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012396. Source: OSTI; NTIS; GPO Dep.

This impact evaluation of the bypass of a slush stock chest that was recently installed at Scott Paper Company (Scott Paper) was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy $avings Plan (E$P) Program. The project consists of installing an adjustable speed drive, a 74.6 kW (100 hp) pump, a re-sized impeller, and piping modifications to bypass the slush stock chest and related equipment. The objective of this impact evaluation was to assess how much electrical energy is being saved at Scott Paper as a result of the E$P and to determine how much the savings cost Bonneville and the region. The impact of the project was evaluated with a combination of engineering analysis, financial analysis, interviews, and submittal reviews (Scott Paper's proposal and completion report). Based on this impact evaluation, energy savings from this project are expected to be 763,600 kilowatt-hours/year (kWh/yr) or 0.087 average megawatts (aMW). On a per-ton basis, this project will save 4.64 kWh/ton or 39.2%. The project cost $120,098 to install, and Scott Paper received payment of $82,232 (in 1993 dollars) from

Bonneville for the acquisition of energy savings. Pacific Northwest Laboratory calculated the real levelized cost of the energy savings to Bonneville as 14.2 mills/kWh (in 1993 dollars) over the project's assumed 15-year life, and the real levelized cost to the region as 21.9 mills/kWh, not including transmission and distribution effects. The project would not have been implemented without the acquisition payment from Bonneville and therefore is not a free rider.

21505 (PNL–10506) **Dual Shell Pressure Balanced Reactor Vessel cooperative research and development agreement with Innotek, Inc., Final report.** Robertus, R.J.; Fassbender, A.G.; Deverman, G.S. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010720. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's Office of Energy Research (OER) has provided support for the development of several chemical processes, including supercritical water oxidation, liquefaction, and aqueous hazardous waste destruction, where chemical and phase transformations are conducted at high pressure and temperature. These and many other commercial processes require a pressure vessel capable of operating in a corrosive environment where safety and economy are important requirements. This document details a cooperative research and development agreement for a novel Dual Shell Pressure Balanced Vessel (DSPBV) which could solve a number of these problems. The Technology could be immediately useful in continuing commercialization of an R&D 100 award-winning technology, Sludge-to-oil Reactor System (STORS), originally developed through funding by OER.

21506 (SAND–94-1199C) **Intelligent systems for induction hardening processes.** Kelley, J.B. (and others); Adkins, D.R.; Robino, C.V. Sandia National Labs., Albuquerque, NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505213–1: International conference on induction hardened gears and precision components, Indianapolis, IN (United States), 15-17 May 1995). Order Number DE95012526. Source: OSTI; NTIS; INIS; GPO Dep.

Induction hardening is widely used to provide enhanced strength, wear resistance, and toughness in components made from medium and high carbon steels. Current limitations of the process include the lack of closed-loop process control, previously unidentified process and material variations which cause continual adjustment of the process parameters, coil and process development by trial and error, and an instability to monitor coil condition. Improvement of the induction hardening process is limited by an inadequate understanding of process fundamentals and material/process interactions. A multidisciplinary team from Sandia National Laboratories and Delphi Saginaw Steering Systems is investigating the induction hardening process under a Cooperative Research and Development Agreement (CRADA). The application of intelligent control algorithms has led to the development of a closed-loop process controller for the combination of one material, one geometry, single frequency, single shot, process that controls to $\pm$ 0.1mm. This controller will be demonstrated on the production floor this year. Our approach and the opportunities for expanding the usefulness of this technology will be described.

21507 (SAND–95-0724) **Prosperity game for the national electronics manufacturing initiative.** Berman, M. (Sandia National Labs., Albuquerque, NM (United States)); VanDevender, J.P.; Berry, I. Sandia National Labs., Albuquerque, NM (United States). May 1995. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012531. Source: OSTI; NTIS; GPO Dep.

Prosperity Games are an outgrowth and adaptation of move/countermove and seminar War Games. Prosperity Games are simulations that explore complex issues in a variety of areas including economics, politics, sociology, environment, education and research. These issues can be examined from a variety of perspectives ranging from a global, macroeconomic and geopolitical viewpoint down to the details of customer/supplier/market interactions in specific industries. All Prosperity Games are unique in that both the game format and the player contributions vary from game to game. This report documents the Prosperity Game conducted under the sponsorship of the Electronics Subcommittee of the Civilian Industrial Technology Committee (under the National Science and Technology Council), and the Electronics Partnership Project. Players were drawn from the electronics industry, from government, national laboratories, and universities, and from Japan and Austria. The primary objectives of this game were: To connect the technical and non-technical (i.e., policy) issues that were developed in the roadmap-making endeavor of the National Electronics Manufacturing Initiative (NENI);to provide energy, enthusiasm and people to help the roadmap succeed; and to provide insight into high-leverage public and private investments. The deliberations and recommendations of these teams provide valuable insights as to the views of this diverse group of decision makers concerning policy changes, foreign competition, the robustness of strategic thinking and planning, and the development, delivery and commercialization of new technologies.

21508 (UCRL-ID–120612) **Electroless nickel recycling via electrodialysis.** Steffani, C.; Meltzer, M. Lawrence Livermore National Lab., CA (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011808. Source: OSTI; NTIS; GPO Dep.

Electroless nickel is widely used in the metal finishing industry as a coating. It plates evenly on a variety of surfaces and replicates or enhances the surface finish. It has high hardness and good corrosion resistance and machinability. However, its bath life is limited and it has a tendency to spontaneously plate out on the tank and associated equipment. These problems add to the cost per unit component plated. Also, expensive waste treatment is required before users can dispose of the spent solution. Electroless nickel's limited bath life is inherent in its chemical make-up. Using hypophosphite as the reducing agent for the nickel ion generates by-products of nickel metal and orthophosphite. When the level of orthophosphite in the solution reaches a high concentration, the reaction slows and finally stops. The bath must be disposed of, and its treatment and replacement costs are high. Metal salts have a tendency to plate out because of the dissolved solids present, and this also makes it necessary to discard the bath. Lawrence Livermore National Laboratory (LLNL) has conducted a study of an electrodialysis process that can reduce both chemical purchases and disposal costs. Electrodialysis employs a membrane, deionized water, and an electromotive potential to separate the orthophosphite and other dissolved solids from the nickel ions. With the aid of the electromotive potential, the dissolved solids migrate across the membrane from the process solution into the water in the recycling unit's holding cell. This migration lowers the total dissolved solids (TDS) in the process solution and improves plating performance. The dialysis process makes it possible to reuse the bath many times without disposal.

21509 (UCRL-JC–119135) **Real-time cleaning performance feedback.** Meltzer, M. Lawrence Livermore National Lab., CA (United States). Dec 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950295–1: National electronic packaging and production conference, Anaheim, CA (United States), 26 Feb - 2 mar 1995). Order Number DE95012474. Source: OSTI; NTIS; GPO Dep.

Monitoring contamination levels on parts during cleaning operations will provide feedback that can be useful in reducing waste generation and air emissions caused by over- or under-cleaning. Such real-time process controls can help eliminate pollution in a wide variety of industries, including aerospace, electronics, and metal finishing.

21510 (VTT-PUB–219) **Methodology for simultaneous robot system safety design.** Kuivanen, R. (VTT Manufacturing Technology, Espoo (Finland). Safety Engineering). Technical Research Centre of Finland, Espoo (Finland); Tampere Univ. of Technology (Finland). 1995. 158p. Order Number DE95779235. Source: OSTI; NTIS.

The design of a production system is a challenging and varied task. The designer of a robot system must realize that a technical solution alone cannot create a safe and effective workplace for people. Industrial robots represent a high degree of automation. The design of robot systems can offer examples for many other

manufacturing systems. This study was done from the point of view of the designer. It concentrates on a narrow design task in order to give the operators of the system a workplace that is as good and sensible, as productive, and as safe as possible. The central objective of this study was to present a simultaneous methodology for the safety design of an industrial robot system. A second objective was to evaluate the results of preliminary safety analyses based on the computer models of robot systems in comparison to the safety analyses of the actual robot systems built. The decisions made by designers and the robot user concerning the safety level and production were evaluated, and the recommendations of robot safety standards were tested under realistic conditions simulated in the laboratory.

3206 Municipalities and Community Systems

Refer also to citation(s) 20719, 21160, 21382, 21422, 21423, 21481, 21505, 22321

21511 (DOE/EA–0980) **300 Area process sewer piping upgrade and 300 Area treated effluent disposal facility discharge to the City of Richland Sewage System, Hanford Site, Richland, Washington.** USDOE Richland Operations Office, WA (United States). May 1995. 65p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012961. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy (DOE) is proposing to upgrade the existing 300 Area Process Sewer System by constructing and operating a new process sewer collection system that would discharge to the 300 Area Treated Effluent Disposal Facility. The DOE is also considering the construction of a tie-line from the TEDF to the 300 Area Sanitary Sewer for discharging the process wastewater to the City of Richland Sewage System. The proposed action is needed because the integrity of the old piping in the existing 300 Area Process Sewer System is questionable and effluents might be entering the soil column from leaking pipes. In addition, the DOE has identified a need to reduce anticipated operating costs at the new TEDF. The 300 Area Process Sewer Piping Upgrade (Project L-070) is estimated to cost approximately $9.9 million. The proposed work would involve the construction and operation of a new process sewer collection system. The new system would discharge the effluents to a collection sump and lift station for the TEDF. The TEDF is designed to treat and discharge the process effluent to the Columbia River. The process waste liquid effluent is currently well below the DOE requirements for radiological secondary containment and is not considered a RCRA hazardous waste or a State of Washington Hazardous Waste Management Act dangerous waste. A National Pollutant Discharge Elimination, System (NPDES) permit has been obtained from the U.S. Environmental Protection Agency for discharge to the Columbia River. The proposed action would upgrade the existing 300 Area Process Sewer System by the construction and operation of a new combined gravity, vacuum, and pressurized process sewer collection system consisting of vacuum collection sumps, pressure pump stations, and buried polyvinyl chloride or similar pipe. Two buildings would also be built to house a main collection station and a satellite collection station.

21512 (LUTMDN-TMVK–5247) **Ouje-Bougoumou district heating study. Trouble shooting and overall system performance.** Gamstedt, Y.; Hansson, M. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Mar 1995. 116p. Order Number DE95779301. Source: OSTI; NTIS.

Examination paper.

The subject for this Master's Thesis is the operation and performance of a small district heating system situated in Ouje-Bougoumou, a native community in the middle of Quebec in Canada. Reasons to perform the study were that deficiencies in the system had been noted in form of higher flow rates and smaller temperature differentials than designed for along with an insufficient supply of district heating to the customers. A monitoring system that registers pressures, temperatures and flow rates in selected points in the district heating system has been developed and installed. An inventory of substations has been done. Information from the monitoring system and the substation inventory has then been used to trouble shoot the system and to evaluate the overall system performance. The result of the study is that an important reason for the dysfunctions in the system is the faulty setting of control valves in substations along with a building internal heating system demanding more flow from the district heating system than designed for. Also the sensors belonging to the faulty set control valves were found to be installed in a faulty position, thereby creating a domestic hot water scalding risk. To transfer well known technology between continents and societies with different social structures is a complicated process. The problems that have occurred in the district heating system in Ouje-Bougoumou quite surely refer to difficulties in this technology transfer process. Refs, 12 figs, 6 tabs, 9 appendices

21513 (LUTMDN-TMVK–5250) **Status assessment of secondary district heating networks.** Aakesson, S.J. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. May 1995. 77p. (In Swedish). Order Number DE95779300. Source: OSTI; NTIS.

Examination paper.

Housing co-operatives in residential areas in Sweden are showing an increased interest in letting the Swedish district heating companies take over their district heating systems. The reason for this is that these district heating piping systems have reached an age where defaults and damages are or are about to become very costly. If the district heating company is to take over the network, the status of the network must be properly assessed to enable an estimation of the remaining (economic) life and to make a correct pricing of the take-over possible. The differences between primary and secondary district heating networks are described, and so are the damages on different parts of the network that may occur. An overview of the most commonly used culvert types is given and furthermore, a model to determine the status of a secondary net is presented. In this model, suggestions for how to describe the heating net are being made and an account of available tools/testing methods which are able to find damages on district heating pipes is given. The study shows that it is difficult to determine the status of the nets, since information about design, construction and maintenance is often limited. This means that when investigating the heating net, you must start with making a thorough description of the design and what has happened during the operation of the net so far. With good knowledge about the net, the continuing study of the net and the selection among available testing methods are made easier. Among the described testing methods that detect and locate leaks, the heat camera and the trace gas give the best results. 21 refs, 7 figs, 4 tabs

21514 (NEI-DK–2049) **District heating. 'Dig-It-Yourself'.** Soerensen, P.A.; Roehr Jensen, J.; Nielsen, U. PlanEnergi S/I (Denmark); Nellemann, Nielsen og Raunschenberger A/S, Alleroed (Denmark); Plastconsult, Randers (Denmark). Mar 1995. 38p. (In Danish). Contract ENS-51191-92.0068. Order Number DE95787756. Source: OSTI; NTIS.

District heating distribution networks in rural areas are normally expensive to construct. In Denmark plastic pipes, in long segments, are now used and various new equipment has been developed for digging them down in the earth. But the price of laying plastic pipes is still the same as for laying plastic ones. It is suggested that a cheap and effective method would be to use a simple drain-spade and a rounded shovel and dig them down by hand, as they should not be buried very deep in the soil. Thus the shovel could be used to remove mud, and the drain-spade for digging and for cleaning up the trench. The earth dug out could be used for filling up the trench again after the pipes have been laid. The earth over the pipes would be 30 cm deep. After the first pipe is laid the earth is filled in so that it is covered with soil up to 20 cm in depth which is then leveled with the help of a water hose. The next pipe is then laid, the dug-out material is used for filling and is stamped down. A warning tape is laid 50 mm over the top of the pipe, the covering is then raised ca.50 mm to give room for the first placing. This more flexible method makes it easier to lay district heating pipes on private grounds. Ground-owners could also do it themselves, it is suggested, whilst still keeping to the standard regulations. 3000 Tax free Danish kroner could be saved in relation to 3 hours manual labour, if this method is used. Hybrid solutions, where other means of laying pipes are combined with the 'Dig-It Yourself' method could save 50% of previous costs. (AB)

21515 (NEI-NO–569, pp. 7-15) **Modelling of municipal solid waste devolatilization: TGA results on the components of MSW and comparison to the TGA behavior of pine.** Krieger-Brockett, B. (Washington Univ. Dept. of Chemical Engineering, Seattle, WA (United States)); Lai, Wei-chuan. Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

Mathematical modelling and experimental results regarding the devolatilization of lodgepole pine, municipal solid waste (MSW) and large particles of densified refuse-derived fuel (d-RDF) have been investigated previously. In this paper, the authors present new thermogravimetric analysis (TGA) data on several MSW constituents. The TGA data will confirm that it is reasonable to use newsprint kinetic parameters to describe the volatiles release for MSW. Also, a comparison is made between the TGA data for d-RDF or MSW and pine, a species of interest in Scandinavia. This comparison is limited to the lowest heating rate in both studies, 5 degrees C/min. Since both of these substances are considered renewable resources, a comparison of their thermal devolatilization behavior in small and large particles is of interest for developing well-designed gasifiers and combustors. 17 refs., 3 figs.

21516 (NEI-NO–569, pp. 17-40) **Overview of IEA biomass gasification activity.** Hustad, J.E. (Norwegian Inst. of Technology (Norway)). Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The IEA Bioenergy Agreement 1992-1994 contains four different tasks. Fifteen countries have now signed the agreement. Task X conversion consists of nine different activities each run by an activity leader. An overview of the biomass gasification activity is presented. In the agreement 1992-1994 there are nine countries participating in this particular activity. The means are information exchange, workshops, site visits, and continued focus on gasifier operation and improvements, and scale up. 4 figs., 7 tabs.

21517 (NEI-NO–569, pp. 41-48) **IEA biomass thermal gasification project.** Babu, S.P. (Institute of Gas Technology, Chicago, IL (United States)); Whaley, T.P. Nordisk Ministerraad. 1993. (CONF-9308267–: Nordic seminar on biomass gasification and combustion, Trondheim (Norway), 30 Aug 1993). In *Nordic seminar on biomass gasification and combustion.* 322p. Order Number DE95779284. Source: OSTI; NTIS.

Sponsored by: NTH. Division of Thermal Energy and Nordic Council of Ministers.

The Biomass Thermal Gasification Project was started in late 1989 as Activity 4 of the IEA Bioenergy Agreement Task 7, Biomass Conversion. This paper reviews the project activities since its beginning, addressing biomass resources, state-of-the-art gasification technology, research needs, and the future project activities that are especially relevant to the nine (9) participating countries: Canada, Denmark, Finland, Italy, The Netherlands, Sweden, Switzerland, the United Kingdom, and the United States of America. 14 refs.

21518 (NREL/CP–462-7900) **Proceedings of the utility renewable energy planning and modeling workshop.** Sweezey, B. (ed.). National Renewable Energy Lab., Golden, CO (United States); Electric Power Research Inst., Palo Alto, CA (United States). [1995]. 345p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC36-83CH10093. (CONF-9504150–: Utility renewable energy planning and modeling workshop, Newton, MA (United States), 19-20 Apr 1995). Order Number DE95004100. Source: OSTI; NTIS; GPO Dep.

Proceedings of the Utility Renewable Energy Planning and Modeling Workshop held April 19–20, 1995, in Newton Massachusetts are documented.

21519 (NREL/TP–463-7844) **Distributed utility technology cost, performance, and environmental characteristics.** Wan, Y.; Adelman, S. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009234. Source: OSTI; NTIS; GPO Dep.

Distributed Utility (DU) is an emerging concept in which modular generation and storage technologies sited near customer loads in distribution systems and specifically targeted demand-side management programs are used to supplement conventional central station generation plants to meet customer energy service needs. Research has shown that implementation of the DU concept could provide substantial benefits to utilities. This report summarizes the cost, performance, and environmental and siting characteristics of existing and emerging modular generation and storage technologies that are applicable under the DU concept. It is intended to be a practical reference guide for utility planners and engineers seeking information on DU technology options. This work was funded by the Office of Utility Technologies of the US Department of Energy.

21520 (ORNL/CON–401) **Measuring persistence: A literature review focusing on methodological issues.** Wolfe, A.K.; Brown, M.A.; Trumble, D. Oak Ridge National Lab., TN (United States). Mar 1995. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011772. Source: OSTI; NTIS; GPO Dep.

This literature review was conducted as part of a larger project to produce a handbook on the measurement of persistence. The past decade has marked the development of the concept of persistence and a growing recognition that the long-term impacts of demand-side management (DSM) programs warrant careful assessment. Although increasing attention has been paid to the topic of persistence, no clear consensus has emerged either about its definition or about the methods most appropriate for its measurement and analysis. This project strives to fill that gap by reviewing the goals, terminology, and methods of past persistence studies. It was conducted from the perspective of a utility that seeks to acquire demand-side resources and is interested in their long-term durability; it was not conducted from the perspective of the individual consumer. Over 30 persistence studies, articles, and protocols were examined for this report. The review begins by discussing the underpinnings of persistence studies: namely, the definitions of persistence and the purposes of persistence studies. Then. it describes issues relevant to both the collection and analysis of data on the persistence of energy and demand savings. Findings from persistence studies also are summarized. Throughout the review, four studies are used repeatedly to illustrate different methodological and analytical approaches to persistence so that readers can track the data collection. data analysis, and findings of a set of comprehensive studies that represent alternative approaches.

21521 (SAND–94-2340) **Off site demonstrations for MWLID technologies.** Williams, C. (Sandia National Labs., Albuquerque, NM (United States)); Gruebel, R. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011835. Source: OSTI; NTIS; INIS; GPO Dep.

Open demonstrations of technologies developed by the Office of Technology Development's (QTD's) Mixed Waste Landfill Integrated Demonstration (MWLID) should facilitate regulatory acceptance and speed the transfer and commercialization of these technologies. The purpose of the present project is to identify the environmental restoration needs of hazardous waste and/or mixed waste landfill owners within a 25-mile radius of Sandia National Laboratories (SNL). Most municipal landfills that operated prior to the mid-1980s accepted household/commercial hazardous waste and medical waste that included low-level radioactive waste. The locations of hazardous and/or mixed waste landfills within the State of New Mexico were. identified using federal, state, municipal and Native American tribal environmental records. The records reviewed included the US Environmental Protection Agency (EPA) Superfund Program CERCLIS Event/Site listing (which includes tribal records), the New Mexico Environment Department (NMED), Solid Waste Bureau mixed waste landfill database, and the City of

Albuquerque Environmental Health Department landfill database. Tribal envirorunental records are controlled by each tribal government, so each tribal environmental officer and governor was contacted to obtain release of specific site data beyond what is available in the CERCLIS listings.

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 20681, 20685, 21533

21522 (ANL/ES/CP–84456) **Future market for ceramics in vehicle engines and their impacts.** Vyas, A. (Argonne National Lab., IL (United States). Center for Transportation Research); Hanson, D.; Stodolsky, F. Argonne National Lab., IL (United States). Feb 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950186–1: 2. world car conference, Riverside, CA (United States), 22-24 Jan 1995). Order Number DE95012403. Source: OSTI; NTIS; GPO Dep.

Ceramic engine components have potential to improve vehicle fuel economy. Some recent tests have also shown their environmental benefits, particularly in reducing particulate emissions in heavy-duty diesel engines. The authors used the data from a survey of the US vehicle engine and component manufacturers relating to ceramic engine components to develop a set of market penetration models. The survey identified promising ceramic components and provided data on the timing of achieving introductory shares in light and heavy-duty markets. Some ceramic components will penetrate the market when the pilot-scale costs are reduced to one-fifth of their current values, and many more will enter the market when the costs are reduced to one-tenth of the current values. An ongoing ceramics research program sponsored by the US Department of Energy has the goal of achieving such price reductions. The size and value of the future ceramic components market and the impacts of this market in terms of fuel savings, reduction in carbon dioxide emissions, and potential reduction in other criteria pollutants are presented. The future ceramic components market will be 9 million components worth $29 million within 5 years of introduction and will expand to 692 million components worth $3,484 million within 20 years. The projected annual energy savings are 3.8 trillion Btu by 5 years, increasing to 526 trillion Btu during the twentieth year. These energy savings will reduce carbon dioxide emissions by 41 million tons during the twentieth year. Ceramic components will help reduce particulate emissions by 100 million tons in 2030 and save the nation's urban areas $152 million. The paper presents the analytical approach and discusses other economic impacts.

21523 (CONF-9503150–1) **Thermal barrier coatings issues in advanced land-based gas turbines.** Parks, W.P. (USDOE Office of Industrial Technologies, Washington, DC (United States)); Lee, W.Y.; Wright, I.G. Oak Ridge National Lab., TN (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Thermal barrier coating workshop; Westlake, OH (United States); 27-29 Mar 1995. Order Number DE95012897. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's Advanced Turbine Systems (ATS) program is aimed at fostering the development of a new generation of land-based gas turbine systems with overall efficiencies significantly beyond those of current state-of-the-art machines, as well as greatly increased times between inspection and refurbishment, improved environmental impact, and decreased cost. The proposed duty cycle of ATS machines will emphasize different criteria in the selection of materials for the critical components. In particular, thermal barrier coatings (TBCS) will be an essential feature of the hot gas path components in these machines. In fact, the goals of the ATS will require significant improvements in TBC technology, since these turbines will be totally reliant on TBCs, which will be required to function on critical components such as the first stage vanes and blades for times considerably in excess of those experienced in current applications. Issues that assume increased importance are the mechanical and chemical stability of the ceramic layer and of the metallic bond coat; the thermal expansion characteristics and compliance of the ceramic layer; and the thermal conductivity across the thickness of the ceramic layer. Obviously, the ATS program provides a very challenging opportunity for TBCs, and involves some significant opportunities to extend this technology. A significant TBC development effort is planned in the ATS program which will address these key issues.

21524 (SAND–95-8563C) **The effects of high ambient density on diesel spray penetration and spread.** Naber, J.D.; Siebers, D.L.; Hencken, K.R. Sandia National Labs., Livermore, CA (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC04-94AL85000 ; AC04-76DP00789. (CONF-9504163–1: Combustion Institute and American Flame Research onference, San Antonio, TX (United States), 23-26 Apr 1995). Order Number DE95010761. Source: OSTI; NTIS; GPO Dep.

The effects of ambient gas density on diesel spray penetration and spread under (a) non-vaporizing, (b) vaporizing, and (c) combusting conditions were examined. Densities more than a factor of two higher than top-dead-center conditions in current technology diesel engines were considered. The results show that the effects of density on non-vaporizing spray penetration are more significant than previously noted, that vaporization processes decrease penetration and spread, and that combustion processes increase penetration and spread of diesel sprays.

3303 Electric-Powered Systems

Refer also to citation(s) 21328, 21329, 21331, 21529, 21778

21525 (ANL/ES/CP–84476) **Simple cost model for EV traction motors.** Cuenca, R.M. Argonne National Lab., IL (United States). Feb 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950186–3: 2. world car conference, Riverside, CA (United States), 22-24 Jan 1995). Order Number DE95013371. Source: OSTI; NTIS; GPO Dep.

A simple cost model has been developed that allows the calculation of the OEM cost of electric traction motors of three different types, normalized as a function of power in order to accommodate different power and size. The model includes enough information on the various elements integrated in the motors to allow analysis of individual components and to factor-in the effects of changes in commodities prices. A scalable cost model for each of the main components of an electric vehicle (EV) is a useful tool that can have direct application in computer simulation or in parametric studies. For the cost model to have wide usefulness, it needs to be valid for a range of values of some parameter that determines the magnitude or size of the component. For instance, in the case of batteries, size may be determined by energy capacity, usually expressed in kilowatt-hours (kWh), while in the case of traction motors, size is better determined by rated power, usually expressed in kilowatts (kW). The simplest case is when the cost of the component in question is a direct function of its size; then cost is simply the product of its specific cost ($/unit size) and the number of units (size) in the vehicle in question. Batteries usually fall in this category (cost = energy capacity x $/kWh). But cost is not always linear with size or magnitude; motors (and controllers), for instance, become relatively less expensive as power rating increases. Traction motors, one of the main components for EV powertrains are examined in this paper, and a simplified cost model is developed for the three most popular design variations.

21526 (ANL/ES/CP–85251) **Electric vehicle performance in 1994 DOE competitions.** Quong, S.; Duoba, M.; Larsen, R.; LeBlanc, N.; Gonzales, R.; Buitrago, C. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950256–8: Society of Automotive Engineers international congress and exposition, Detroit, MI (United States), 27 Feb - 2 mar 1995). Order Number DE95012285. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) through Argonne National Laboratory sponsored and recorded energy data of electric vehicles (EVs) at five competitions in 1994. Each competition provided different test conditions (closed-track, on-road, and dynamometer). The data gathered at these competitions includes energy efficiency, range, acceleration, and vehicle characteristics. The results of the analysis show that the vehicles performed as expected. Some of the EVs were also tested on dynamometers and compared to gasoline vehicles, including production vehicles with advanced battery systems. Although the EVs performed well at these competitions, the results show that only the vehicles with advanced technologies perform as well or better than conventional gasoline vehicles.

21527 (DOE/ID/13074–T15) **Year Four, 104th Congress, 3rd quarter report, January 1, 1995–March 31, 1995. DOE/KEURP Site Operator Program.** Kansas State Univ., Manhattan, KS (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-91ID13074. Order Number DE95012413. Source: OSTI; NTIS; GPO Dep.

Kansas State University is participating in the Department of Energy's Electric Vehicle Site Operator Program. Kansas State is displaying, testing, and evaluating electric or hybrid vehicle technology. This participation will provide organizations an opportunity to examine the latest EHV prototypes under actual operating conditions.

21528 (NEI-DK–2026, pp. 227-234) **The RUF-system.** Jensen, P.R. (RUF-International, Frederiksberg (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (CONF-9408240–Vol.1: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 1.* 223p. Order Number DE95787784. Source: OSTI; NTIS.

Short communication RAIL TRANSPORT; HYBRID ELECTRIC-POWERED VEHICLES; TRANSPORTATION SECTOR; URBAN AREAS; SPECIFICATIONS; FEASIBILITY STUDIES

3304 Hybrid Systems

Refer also to citation(s) 21527

21529 (ANL/ES/CP–85263) **Technical analysis of the 1994 HEV challenge.** LeBlanc, N.M.; Duoba, M.; Quong, S.; Larsen, R.P.; Stithim, M.; Rimkus, W. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950256–9: Society of Automotive Engineers international congress and exposition, Detroit, MI (United States), 27 Feb - 2 mar 1995). Order Number DE95012933. Source: OSTI; NTIS; GPO Dep.

The 1994 Hybrid Electric Vehicle Challenge provided the backdrop for collecting data and developing testing procedures for hybrid electric vehicle technology available at colleges and universities across North America. The data collected at the competition was analyzed using the HEV definitions from the draft SAE J1711 guidelines. The energy economy, percentage of electrical to total energy used, and acceleration performance was analyzed for any correlation between the over-the-road data and the commuter-sustaining, commuter-depleting, and reserve-sustaining hybrid vehicles. The analysis did not provide any direct correlation between over-the-road data and the three hybrid types. The analysis did show that the vehicle configurations provide the best information on vehicle performance. It was also clear that a comprehensive data analysis system along with a well-defined testing procedure would allow for a more complete analysis of the data.

21530 (ANL/ES/CP–85350) **Testing hybrid electric vehicle emissions and fuel economy at the 1994 Hybrid Electric Vehicle Challenge.** Duoba, M.; Quong, S.; LeBlanc, N.; Larsen, R.P. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950256–7: Society of Automotive Engineers international congress and exposition, Detroit, MI (United States), 27 Feb - 2 mar 1995). Order Number DE95012468. Source: OSTI; NTIS; GPO Dep.

From June 12–20, 1994, an engineering design competition called the 1994 Hybrid Electric Vehicle (HEV) Challenge was held in Southfield, Michigan. This collegiate-level competition, which involved 36 colleges and universities from across North America, challenged the teams to build a superior HEV. One component of this comprehensive competition was the emissions event. Special HEV testing procedures were developed for the competition to find vehicle emissions and correct for battery state-of-charge while fitting into event time constraints. Although there were some problems with a newly-developed data acquisition system, they were able to get a full profile of the best performing vehicles as well as other vehicles that represent typical levels of performance from the rest of the field. This paper will explain the novel test procedures, present the emissions and fuel economy results, and provide analysis of second-by-second data for several vehicles.

21531 (UCRL-JC–120151) **Hybrid vehicle system studies and optimized hydrogen engine design.** Smith, J.R.; Aceves, S. Lawrence Livermore National Lab., CA (United States). 26 Apr 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504160–3: 1995 DOE/NREL hydrogen program review, Coral Gables, FL (United States), 18-21 Apr 1995). Order Number DE95013438. Source: OSTI; NTIS; GPO Dep.

We have done system studies of series hydrogen hybrid automobiles that approach the PNGV design goal of 34 km/liter (80 mpg), for 384 km (240 mi) and 608 km (380 mi) ranges. Our results indicate that such a vehicle appears feasible using an optimized hydrogen engine. We have evaluated the impact of various on-board storage options on fuel economy. Experiments in an available engine at the Sandia CRF demonstrated NO_x emissions of 10 to 20 ppm at an equivalence ratio of 0.4, rising to about 500 ppm at 0.5 equivalence ratio using neat hydrogen. Hybrid simulation studies indicate that exhaust NO_x concentrations must be less than 180 ppm to meet the 0.2 g/mile ULEV or Federal Tier II emissions regulations. LLNL has designed and fabricated a first generation optimized hydrogen engine head for use on an existing Onan engine. This head features 15:1 compression ratio, dual ignition, water cooling, two valves and open quiescent combustion chamber to minimize heat transfer losses. Initial testing shows promise of achieving an indicated efficiency of nearly 50% and emissions of less than 100 ppm NO_x. Hydrocarbons and CO are to be measured, but are expected to be very low since their only source is engine lubricating oil. A successful friction reduction program on the Onan engine should result in a brake thermal efficiency of about 42% compared to today's gasoline engines of 32%. Based on system studies requirements, the next generation engine will be about 2 liter displacement and is projected to achieve 46% brake thermal efficiency with outputs of 15 kW for cruise and 40 kW for hill climb.

3306 Vehicle Design Factors

21532 (ANL/ES/CP–84474) **Lightweight materials in the light-duty passenger vehicle market: Their market penetration potential and impacts.** Stodolsky, F. (Argonne National Lab., IL (United States). Center for Transportation Research); Vyas, A.; Cuenca, R. Argonne National Lab., IL (United States). [1995]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950186–2: 2. world car conference, Riverside, CA (United States), 22-24 Jan 1995). Order Number DE95012462. Source: OSTI; NTIS; GPO Dep.

This paper summarizes the results of a lightweight materials study. Various lightweight materials are examined and the most cost effective are selected for further analysis. Aluminum and high-performance polymer matrix composites (PMCS) are found to have the highest potential for reducing the weight of automobiles and passenger-oriented light trucks. Weight reduction potential for aluminum and carbon fiber-based PMCs are computed based on a set of component-specific replacement criteria (such as stiffness and strength), and the consequent incremental cost scenarios are developed. The authors assume that a materials R and D program successfully reduces the cost of manufacturing aluminum and carbon fiber PMC-intensive vehicles. A vehicle choice model is used to project market shares for the lightweight vehicles. A vehicle survival and age-related usage model is employed to compute energy

consumption over time for the vehicle stock. After a review of projected costs, the following two sets of vehicles are characterized to compete with the conventional materials vehicles: (1) aluminum vehicles with limited replacement providing 19% weight reduction (AIV-Mid), and (2) aluminum vehicles with the maximum replacement providing 31% weight reduction (AIV-Max). Assuming mass-market introduction in 2005, the authors project a national petroleum energy savings of 3% for AIV-Mid and 5% for AIV-Max in 2030.

21533 (ANL/ES/CP–85239) **Modeling the effect of engine assembly mass on engine friction and vehicle fuel economy.** An, Feng (University of California, Riverside, CA (United States)); Stodolsky, F. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950256–10: Society of Automotive Engineers international congress and exposition, Detroit, MI (United States), 27 Feb - 2 mar 1995). Order Number DE95012936. Source: OSTI; NTIS; GPO Dep.

In this paper, an analytical model is developed to estimate the impact of reducing engine assembly mass (the term engine assembly refers to the moving components of the engine system, including crankshafts, valve train, pistons, and connecting rods) on engine friction and vehicle fuel economy. The relative changes in frictional mean effective pressure and fuel economy are proportional to the relative change in assembly mass. These changes increase rapidly as engine speed increases. Based on the model, a 25% reduction in engine assembly mass results in a 2% fuel economy improvement for a typical mid-size passenger car over the EPA Urban and Highway Driving Cycles.

3307 Emission Control

Refer also to citation(s) 21530, 21539, 22205, 22209

21534 (CONF-950892–6) **Al_2O_3/CeO_2 Washcoats for three-way automotive emission catalysts.** Kenik, E.A. (Oak Ridge National Lab., TN (United States)); More, K.L.; LaBarge, W.; Beckmeyer, R. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95012894. Source: OSTI; NTIS; GPO Dep.

Pt-Rh based three-way catalysts are the primary catalytic system for control of hydrocarbon, CO, and NO_x automotive emissions. Mixed Al_2O_3/CeO_2 oxides are often dispersed on a cordierite honeycomb monolith as a washcoat and act as a high-surface-area carrier for the heavy metal catalyst clusters. Conversion efficiency and lifetime of a converter is determined by the microstructure of the washcoat/monolith and its evolution during high-temperature exposure to the exhaust gas. SEM, electron microprobe analysis, and analytical electron microscopy were used to study these catalysts before and after engine dynamometer tests, with max monolith temperatures of 1000 and 1150 C.

21535 (SAND–95-8522C) **Development of a method for in-cylinder tracking of a fuel additive for NO_x control.** Dec, J.E. (Sandia National Labs., Livermore, CA (United States)); Espey, C. Sandia National Labs., Livermore, CA (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410309–3: Contractor's coordination meeting, Dearborn, MI (United States), 24-27 Oct 1994). Order Number DE95010752. Source: OSTI; NTIS; GPO Dep.

The development of a NO_x-reducing fuel additive for diesel engines offers a potentially superior alternative to more classic NO_x reduction techniques. A key element in making this additive work successfully is to make it survive until late in the combustion event. To help guide the development of the additive, a technique for measuring the evolution of the additive distribution in the combusting fuel jet of an operating diesel engine is proposed and investigated. This proposed technique is based on planar laser-induced fluorescence (PLIF) imaging in an optically accessible diesel engine. The induced fluorescence must be unique to the additive, and it could arise from either the additive itself or from a hydrocarbon complex (fluorescent tag) attached to the additive molecule. Using a luminescence spectrometer, a fluorescent emission from the base additive (Texaco's batch no. 40725-6) was identified that is unique from any fuel fluorescence and out of the typical range of poly-aromatic hydrocarbon (PAH) fluorescence. Then, preliminary PLIF images were obtained in the firing engine to determine whether this fluorescence emission can be used to track the evolution of the additive distribution. Temporal sequences of these preliminary PLIF images obtained with and without the additive in the fuel are presented. Problems with interference from PAH fluorescence and steps taken to mitigate the problem are presented and discussed. However, a fundamental problem is identified in using the natural fluorescence signal from this particular additive formulation to track the breakdown of the additive shell and the release of the active component in the cylinder of the engine. Alternative methods of achieving the desired results are discussed.

3308 Alternative Fuels

Refer also to citation(s) 21068, 21069

21536 (ANL/ES/CP–85765) **Alternative-fuels technology: Natural gas vehicles as a way to curb urban air pollution.** Argonne National Lab., IL (United States). Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950256–6: Society of Automotive Engineers international congress and exposition, Detroit, MI (United States), 27 Feb - 2 mar 1995). Order Number DE95012216. Source: OSTI; NTIS; GPO Dep.

This report describes the use of natural gas as an alternative fuel in various vehicles. Safety and emissions resulting from combustion are briefly discussed.

21537 (ANL/ES/PP–79436) **Emissions from ethanol- and LPG-fueled vehicles.** Pitstick, M.E. Argonne National Lab., IL (United States). [1995]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012214. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses the environmental concerns of using neat ethanol and liquefied petroleum gas (LPG) as transportation fuels in the United States. Low-level blends of ethanol (10%) with gasoline have been used as fuels in the United States for more than a decade, but neat ethanol (85% or more) has only been used extensively in Brazil. LPG, which consists mostly of propane, is already used extensively as a vehicle fuel in the United States, but its use has been limited primarily to converted fleet vehicles. Increasing U.S. interest in alternative fuels has raised the possibility of introducing neat-ethanol vehicles into the market and expanding the number of LPG vehicles. Use of such vehicles, and increased production and consumption of fuel ethanol and LPG, will undoubtedly have environmental impacts. If the impacts are determined to be severe, they could act as barriers to the introduction of neat-ethanol and LPG vehicles. Environmental concerns include exhaust and evaporative emissions and their impact on ozone formation and global warming, toxic emissions from fuel combustion and evaporation, and agricultural impacts from production of ethanol. The paper is not intended to be judgmental regarding the overall attractiveness of ethanol or LPG as compared with other transportation fuels. The environmental concerns are reviewed and summarized, but only conclusion reached is that there is no single concern that is likely to prevent the introduction of neat-ethanol-fueled vehicles or the increase in LPG-fueled vehicles.

21538 (NREL/TP–425-7529) **Advanced hydrogen/methanol utilization technology demonstration. Phase II: Hydrogen cold start of a methanol vehicle.** National Renewable Energy Lab., Golden, CO (United States); Hydrogen Consultants, Inc., Littleton, CO (United States). May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004092. Source: OSTI; NTIS; GPO Dep.

This is the Phase 11 Final Report on NREL Subcontract No. XR-2-11175-1 "Advanced Hydrogen/Methane Utilization Demonstration" between the National Renewable Energy Laboratory (NREL), Alternative Fuels Utilization Program, Golden, Colorado and Hydrogen Consultants, Inc. (HCI), Littleton, Colorado. Mr.

Chris Colucci was NREL's Technical Monitor. Colorado State University's (CSU) Engines and Energy Conversion Laboratory was HCI's subcontractor. Some of the vehicle test work was carried out at the National Center for Vehicle Emissions Control and Safety (NCVECS) at CSU. The collaboration of the Colorado School of Mines is also gratefully acknowledged. Hydrogen is unique among alternative fuels in its ability to burn over a wide range of mixtures in air with no carbon-related combustion products. Hydrogen also has the ability to burn on a catalyst, starting from room temperature. Hydrogen can be made from a variety of renewable energy resources and is expected to become a widely used energy carrier in the sustainable energy system of the future. One way to make a start toward widespread use of hydrogen in the energy system is to use it sparingly with other alternative fuels. The Phase I work showed that strong affects could be achieved with dilute concentrations of hydrogen in methane (11). Reductions in emissions greater than the proportion of hydrogen in the fuel provide a form of leverage to stimulate the early introduction of hydrogen. Per energy unit or per dollar of hydrogen, a greater benefit is derived than simply displacing fossil-fueled vehicles with pure hydrogen vehicles.

21539 (NREL/TP–425-7609) **Development of an ultra-safe, ultra-low emissions natural gas-fueled bus. Phase 1: Systems design – Final report.** Kubesh, J. (Southwest Research Inst., San Antonio, TX (United States)). National Renewable Energy Lab., Golden, CO (United States); Southwest Research Inst., San Antonio, TX (United States). May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009226. Source: OSTI; NTIS; GPO Dep.

The National Renewable Energy Laboratory (NREL) contracted with Southwest Research Institute (SwRI) to develop an ultra-safe, ultra-low emissions natural gas-fueled school bus. To develop the bus, SwRI teamed with Blue Bird, Incorporated, a school bus manufacturer, Deere Power Systems Group, an engine manufacturer, and CNG Cylinder Company, a supplier of compressed natural gas storage and handling systems. The primary focus of work for Phase 1 was the design of the component systems, i.e. vehicle, engine, and fuel storage systems. The bus chassis prototype is expected to be completed by the middle of July, 1995. A complete prototype vehicle body and chassis should be delivered to SwRI by the beginning of December, 1995. This prototype vehicle will include the new compressed natural gas cylinders and associated fuel storage system hardware which has been designed by CNG Cylinder Company.

35 ARMS CONTROL

3501 Policy, Negotiations, and Legislation

21540 (ANL/DIS/CP–85862) **A comparison of national compliance legislation under the chemical weapons convention.** Tanzman, E.A. Argonne National Lab., IL (United States). 3 Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States);Argonne National Lab., IL (United States). DOE Contract W-31109-ENG-38. Contract DNA001-90-C-0177. (CONF-9503143–1: Compliance systems for disarmament treaties: a workshop on the promotion and enforcement of international law, Toronto (Canada), 3 Mar 1995). Order Number DE95011796. Source: OSTI; NTIS; GPO Dep.

The Chemical Weapons Convention (CWC) is unique among multilateral arms control agreements in requiring national compliance legislation. This paper discusses the compliance legislation enacted by Australia, Germany, Norway, South Africa, and Sweden in anticipation of this agreement entering into force. It compares how these five nations addressed the requirement for legislation to penalize violations of the Convention, as well as how they have developed legal mechanisms to acquire the information about dual-use chemicals that must be declared to the Organisation for the Prohibition of Chemical Weapons. This analysis shows that although different options exist to meet these treaty requirements, areas of consistency between nations are emerging that will encourage universal compliance as the regime matures.

21541 (ANL/DIS/CP–86454) **Legal aspects of national implementation of the chemical wseapons convention confidential provisions.** Tanzman, E.A.; Kellman, B. Argonne National Lab., IL (United States). 9 May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505207–2: Regional seminar on the national implementation of the chemical weapons convention, Yamoussoukro (South Africa), 9 May 1995). Order Number DE95011843. Source: OSTI; NTIS; GPO Dep.

Today, I shall discuss legal aspects of implementing the Chemical Weapons Convention's (CORK) confidentiality provisions. These implementing measures are universal, applying not only to the few States Parties that will declare and destroy chemical weapons, but also to the many States Parties that have never had a chemical weapons program. Progress is reported in actually developing implementing measures for the cork's confidentiality requirements from Australia, Germany, Norway, South Africa, and Sweden.

21542 (ANL/DIS/CP–86455) **Legal aspects of national implementation of the Chemical Weapons Convention transfer provisions.** Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505207–1: Regional seminar on the national implementation of the chemical weapons convention, Yamoussoukro (South Africa), 9 May 1995). Order Number DE95011844. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses legal aspects of implementing the Chemical Weapons Convention's (CWC's) export and import provisions. These implementing measures are universal, applying not only to the few States Parties that will declare and destroy chemical weapons, but also to the many States Parties that have never had a chemical weapons program. This new need for national measures to implement multilateral arms control agreements has generated unease due to a perception that implementation may be burdensome and at odds with national law. In 1993, concerns arose that the complexity of integrating the treaty with national law would cause each nation to effectuate the Convention without regard to what other nations were doing, thereby engendering significant disparities in implementation steps among States Parties. As a result, the author and his colleagues prepared the Manual for National Implementation of the Chemical Weapons Convention. The Manual tries to increase understanding of the Convention by identifying its obligations and suggesting methods of meeting them. Here the author discusses progress among several States in actually developing implementing measures for the Convention's transfer requirements. CWC legislation from australia, Germany, Norway, South Africa, and Sweden were available at this writing in English through the Provisional Technical Secretariat. Of course, it is important to note that this brief survey necessarily omitted examination of the existing background of other, related domestic laws that these signatories might also have adopted that affect CWC implementation.

21543 (DOE/EIS–0218D-Summ.) **Proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel. Summary.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012336. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Department of Energy and United States Department of State are jointly proposing to adopt a policy to manage spent nuclear fuel from foreign research reactors. Only spent nuclear fuel containing uranium enriched in the United States would be covered by the proposed policy. The purpose of the proposed policy is to promote U.S. nuclear weapons nonproliferation policy objectives, specifically by seeking to reduce highly-enriched uranium from civilian commerce. This is a summary of the Draft Environmental Impact Statement. Environmental effects and policy considerations of three Management Alternative approaches for implementation of the proposed policy are assessed. The three Management Alternatives analyzed are: (1) acceptance and management of the spent nuclear fuel by the Department of Energy in the United States, (2) management of the spent nuclear fuel at one or more foreign facilities (under conditions that satisfy United States nuclear weapons nonproliferation policy objectives), and (3)

a combination of components of Management Alternatives 1 and 2 (Hybrid Alternative). A No Action Alternative is also analyzed. For each Management Alternative, there are a number of alternatives for its implementation. For Management Alternative 1, this document addresses the environmental effects of various implementation alternatives such as varied policy durations, management of various quantities of spent nuclear fuel, and differing financing arrangements. Environmental impacts at various potential ports of entry, along truck and rail transportation routes, at candidate management sites, and for alternate storage technologies are also examined. For Management Alternative 2, this document addresses two subalternatives: (1) assisting foreign nations with storage; and (2) assisting foreign nations with reprocessing of the spent nuclear fuel.

21544 (DOE/EIS–0218D-Vol.1) **Draft Environmental Impact Statement on a proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel. Volume 1.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 444p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012337. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Department of Energy and United States Department of State are jointly proposing to adopt a policy to manage spent nuclear fuel from foreign research reactors. Only spent nuclear fuel containing uranium enriched in the United States would be covered by the proposed policy. The purpose of the proposed policy is to promote U.S. nuclear weapons nonproliferation policy objectives, specifically by seeking to reduce highly-enriched uranium from civilian commerce. Environmental effects and policy considerations of three Management Alternative approaches for implementation of the proposed policy are assessed. The three Management Alternatives analyzed are: (1) acceptance and management of the spent nuclear fuel by the Department of Energy in the United States, (2) management of the spent nuclear fuel at one or more foreign facilities (under conditions that satisfy United States nuclear weapons nonproliferation policy objectives), and (3) a combination of components of Management Alternatives 1 and 2 (Hybrid Alternative). A No Action Alternative is also analyzed. For each Management Alternative, there are a number of alternatives for its implementation. For Management Alternative 1, this document addresses the environmental effects of various implementation alternatives such as varied policy durations, management of various quantities of spent nuclear fuel, and differing financing arrangements. Environmental impacts at various potential ports of entry, along truck and rail transportation routes, at candidate management sites, and for alternate storage technologies are also examined. For Management Alternative 2, this document addresses two subalternatives: (1) assisting foreign nations with storage; and (2) assisting foreign nations with reprocessing of the spent nuclear fuel. Management Alternative 3 analyzes a hybrid alternative. This document is Vol. 1 of 2 plus summary volume.

21545 (DOE/EIS–0218D-Vol.2-App.A) **Proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Appendix A, environmental justice analysis. Volume 2.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 50p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012338. Source: OSTI; NTIS; INIS; GPO Dep.

This is Appendix A to a draft Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel. This appendix addresses environmental justice for the acceptance of foreign research reactor spent nuclear fuel containing uranium enriched in the United States. Analyses of environmental justice concerns are provided in three areas: (1) potential ports of entry, (2) potential transportation routes from candidate ports of entry to interim management sites, and (3) areas surrounding potential interim management sites. These analyses lead to the conclusion that the alternatives analyzed in this Environmental Impact Statement (EIS) would result in no disproportionate adverse effects on minority populations or low-income communities surrounding the candidate ports, transport routes, or interim management sites.

21546 (DOE/EIS–0218D-Vol.2-App.B) **Proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Appendix B, foreign research reactor spent nuclear fuel characteristics and transportation casks. Volume 2.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 61p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012339. Source: OSTI; NTIS; INIS; GPO Dep.

This is Appendix B of a draft Environmental Impact Statement (EIS) on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel. It discusses relevant characterization and other information of foreign research reactor spent nuclear fuel that could be managed under the proposed action. It also discusses regulations for the transport of radioactive materials and the design of spent fuel casks.

21547 (DOE/EIS–0218D-Vol.2-App.C) **Proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Appendix C, marine transport and associated environmental impacts. Volume 2.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 43p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012340. Source: OSTI; NTIS; INIS; GPO Dep.

This is Appendix C to a Draft Environmental Statement on a Proposed Nuclear Weapon Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel. Shipment of any material via ocean transport entails risks to both the ship's crew and the environment. The risks result directly from transportation-related accidents and, in the case of radioactive or other hazardous materials, also include exposure to the effects of the material itself. This appendix provides a description of the approach used to assess the risks associated with the transport of foreign research reactor spent nuclear fuel from a foreign port to a U.S. port(s) of entry. This appendix also includes a discussion of the shipping configuration of the foreign research reactor spent nuclear fuel, the possible types of vessels that could be used to make the shipments, the risk assessment methodology (addressing both incident-free and accident risks), and the results of the analyses. Analysis of activities in the port(s) is described in Appendix D. The incident-free and accident risk assessment results are presented in terms of the per shipment risk and total risks associated with the basic implementation of Management Alternative 1and other implementation alternatives. In addition, annual risks from incident-free transport are developed.

21548 (DOE/EIS–0218D-Vol.2-App.D) **Proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Appendix D, selection and evaluation of potential ports of entry. Volume 2.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 303p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012341. Source: OSTI; NTIS; INIS; GPO Dep.

This is an appendix to a draft Environmental Impact Statement (EIS) on a proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel. This appendix describes the process used by the Department of Energy in selecting the potential ports of entry analyzed in this EIS. In addition the appendix provides the basic information required to evaluate ports and port activities, and the potential environmental impacts (incident-free and accidents) associated with the receipt and handling of foreign research reactor spent nuclear fuel from vessels to intermodal transport in ports.

21549 (DOE/EIS–0218D-Vol.2-App.E) **Draft environmental impact statement on a proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Volume 2, Appendix E, Evaluation of human health effects of overland transportation.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 228p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012342. Source: OSTI; NTIS; INIS; GPO Dep.

This Appendix provides an overview of the approach used to assess the human health risks that may result from the overland transportation of foreign research reactor spent nuclear fuel. The

Appendix includes discussion of the scope of the assessment, analytical methods used for the risk assessment (i.e., computer models), important assessment assumptions, determination of potential transportation routes, and presents the results of the assessment. In addition, to aid in the understanding and interpretation of the results, specific arm of uncertainty are described, with an emphasis an how the uncertainties may affect comparisons of the alternatives. he approach used in this Appendix is modeled after that used in the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Draft Environmental Impact Statement (SNF&INEL Draft EIS) (DOE, 1994b). The SNF&INEL Draft EIS did not perform as detailed an analysis on the specific actions taken for foreign research reactor spent nuclear fuel because of the breadth necessary to analyze the entire spent fuel management program. However, the fundamental assumptions used in this analysis are consistent with those used in the SNF & INEL Draft EIS (DOE, 1994b), and the same computer codes and generic release and accident data are used. The risk assessment results are presented in this Appendix in terms of "Per-shipment" risk factors, as well as for the total risks associated with each alternative. Per-shipment risk factors provide an estimate of the risk from a single spent nuclear fuel shipment between a specific origin and destination. They are calculated for all possible origin and destination pairs for each spent nuclear fuel type. The total risks for a given alternative are found by multiplying the expected number of shipments by the appropriate per-shipment risk factors. This approach provides maximum flexibility for determining the risks for a large number of potential alternatives.

21550 (DOE/EIS–0218D-Vol.2-App.G) **Draft environmental impact statement on a proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Volume 2, Appendix G, Background documents.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012344. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix contains background documents, including a fact sheet, memoranda, and a policy proposal.

3502 Proliferation

Refer also to citation(s) 21059, 21403

21551 (UCRL-ID–118538) **Hydronuclear experiments: Why they are not a proliferation danger.** Bailey, K.C. Lawrence Livermore National Lab., CA (United States). 28 Sep 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015380. Source: OSTI; NTIS; GPO Dep.

Short communication NUCLEAR WEAPONS/proliferation; NUCLEAR WEAPONS/testing; STOCKPILES; PROLIFERATION; TESTING; NUCLEAR DISARMAMENT; DESIGN

21552 (UCRL-LR–114070-8) **Director's series on proliferation.** Bailey, K.C. (ed.). Lawrence Livermore National Lab., CA (United States). 1 Jun 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012256. Source: OSTI; NTIS; GPO Dep.

The Director's Series on Proliferation is an occasional publication of essays on the topics of nuclear, chemical, biological, and missile proliferation. The papers included in this series are: GPS-guided cruise missiles and weapons of mass destruction; emergent security issues in South Asia; misconceptions about the cooperative threat reduction program; solving the proliferation puzzle: the role of theory in nonproliferation analysis; a critique of the fissile materials cutoff proposal; and the United Nations special commission on Iraq: a period of transition.

3503 Verification

Refer also to citation(s) 21047, 21696, 22125

21553 (CONF-9404100–) **Proceedings of the symposium on the Non-Proliferation Experiment (NPE): Results and implications for test ban treaties.** Denny, M.D.; Stull, S.P. (eds.). Lawrence Livermore National Lab., CA (United States). [1994]. 599p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From Symposium on the nonproliferation experiment results and implications for test ban treaties; Rockville, MD (United States); 19-21 Apr 1994. Order Number DE95011413. Source: OSTI; NTIS; GPO Dep.

The large amounts of chemical explosives used worldwide in mining, quarrying, and civil engineering projects presents a challenge for policy makers molding a test ban, since their use could provide the necessary cover for a clandestine nuclear test. The Non-Proliferation Experiment (NPE) seeks to measure certain differences between an underground nuclear test and a chemical explosion in the same geology. Two chemical explosions were detonated at the Nevada Test Site to compare their signatures with previous nuclear tests. This conference presents results of these tests and discusses implications for test ban treaties. Conference papers are divided into the following sections: Background; Test preparations; EOS and code simulations; Rainier Mesa structure; Ground motion measurements; Non-seismic technologies; On-site inspection technologies; and a panel discussion. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

21554 (LA–12942-MS) **Comparison of chemical and nuclear explosions: Numerical simulations of the Non-Proliferation Experiment.** Kamm, J.R.; Bos, R.J. Los Alamos National Lab., NM (United States). Jun 1995. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012989. Source: OSTI; NTIS; GPO Dep.

In this paper the authors discuss numerical simulations of the Non-Proliferation Experiment (NPE), which was an underground explosion conducted in September 1993 in the volcanic tuff of the Nevada Test Site. The NPE source consisted of 1.29×10^6 kg of ANFO-emulsion blasting agent, with the approximate energy of 1.1 kt, emplaced 389 m beneath the surface of Rainier Mesa. The authors compare detailed numerical simulations of the NPE with data collected from that experiment, and with calculations of an equally energetic nuclear explosion in identical geology. Calculated waveforms, at ranges out to approximately 1 km, agree moderately well in the time domain with free-field data, and are in qualitative agreement with free-surface records. Comparison of computed waveforms for equally energetic chemical and nuclear sources reveals relatively minor differences beyond the immediate near-source region, with the chemical source having an ~25% greater seismic moment but otherwise indistinguishable (close-in) seismic source properties. 41 refs., 67 figs., 7 tabs.

21555 (LA-UR–95-1417) **Cooling tower and plume modeling for satellite remote sensing applications.** Powers, B.J. Los Alamos National Lab., NM (United States). [1995]. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012000. Source: OSTI; NTIS; GPO Dep.

It is often useful in nonproliferation studies to be able to remotely estimate the power generated by a power plant. Such information is indirectly available through an examination of the power dissipated by the plant. Power dissipation is generally accomplished either by transferring the excess heat generated into the atmosphere or into bodies of water. It is the former method with which we are exclusively concerned in this report. We discuss in this report the difficulties associated with such a task. In particular, we primarily address the remote detection of the temperature associated with the condensed water plume emitted from the cooling tower. We find that the effective emissivity of the plume is of fundamental importance for this task. Having examined the dependence of the plume emissivity in several IR bands and with varying liquid water content and droplet size distributions, we conclude that the plume emissivity, and consequently the plume brightness temperature, is dependent upon not only the liquid water content and band, but also upon the droplet size distribution. Finally, we discuss models dependent upon a detailed point-by-point description of the hydrodynamics and thermodynamics of the plume dynamics and those based upon spatially integrated models. We describe in detail a new integral model, the LANL Plume Model, which accounts

for the evolution of the droplet size distribution. Some typical results obtained from this model are discussed.

21556 (SAND–94-3250) **Enhancing regional security agreements through cooperative monitoring.** Pregenzer, A.L. Sandia National Labs., Albuquerque, NM (United States). May 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013828. Source: OSTI; NTIS; INIS; GPO Dep.

This paper proposes that strengthening regional capabilities for formulating and implementing arms control and confidence-building measures is a tangible method of enhancing regional security. It discusses the importance of developing a regional infrastructure for arms control and confidence building and elucidates the role of technology in facilitating regional arms control and confidence-building agreements. In addition, it identifies numerous applications for regional cooperative monitoring in the areas of arms control, resource management, international commerce and disaster response. The Cooperative Monitoring Center at Sandia National Laboratories, whose aim is to help individual countries and regions acquire the tools they need to develop their own solutions to regional problems, is discussed briefly. The paper ends with recommendations for establishing regional cooperative monitoring centers.

21557 (SAND–95-1191C) **Hypervelocity impact testing of spacecraft optical sensors.** Sandia National Labs., Albuquerque, NM (United States). [1995]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950846–1: American Physical Society biennial conference on shock compression of condensed matter, Seattle, WA (United States), 13-18 Aug 1995). Order Number DE95013870. Source: OSTI; NTIS; GPO Dep.

Hypervelocity tests of spacecraft optical sensors were conducted to determine if the optical signature from an impact inside the optical sensor sunshade resembled signals that have been observed on-orbit. Impact tests were conducted in darkness and with the ejected debris illuminated. The tests were conducted at the Johnson Space Center Hypervelocity Impact Test Facility. The projectile masses and velocities that may be obtained at the facility are most representative of the hypervelocity particles thought to be responsible for a group of anomalous optical sensors responses that have been observed on-orbit. The projectiles are a few micrograms, slightly more massive than the microgram particles thought to be responsible for the signal source. The test velocities were typically 7.3 km/s, which are somewhat slower than typical space particles.

21558 (UCRL-ID–120931) **The NPE gas tracer test and the development of on-site inspection techniques.** Carrigan, C.; Heinle, R.; Zucca, J.J. Lawrence Livermore National Lab., CA (United States). 13 Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011693. Source: OSTI; NTIS; GPO Dep.

Tracer gases emplaced in or near the detonation cavity of the 1-kiloton NonProliferation Event required 1.5 and 13.5 months for sulfur hexaflouride and helium-3, respectively, to reach the surface of Rainier Mesa from an emplacement depth of 400 meters. The sites that first produced tracer gases are those located in known faults and fractures. Numerical modeling suggests that transport to the surface is accomplished within this time frame through atmospheric pumping along high permeability pathways such as fractures. The difference in travel time between the two tracers is due to differences in gas diffusivity and can also be explained by our numerical modeling.

36 MATERIALS

Refer also to citation(s) 21216, 21379, 21713, 22369

21559 (ANL/MSD/CP–86321) **Synthesis, properties, and applications of nanophase materials.** Siegel, R.W. (Max-Planck-Institut fuer Mikrostrukturphysik, Halle/Saale (Germany)). Argonne National Lab., IL (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9506197–1: International colloquium on plasma processes, Antibes-Juan-les-Pins (France), 11-15 Jun 1995). Order Number DE95013521. Source: OSTI; NTIS; GPO Dep.

Work on the synthesis, properties, and applications of nanophase materials has developed rapidly during the past decade. A wide variety of methods now exist for their production, including several plasma-based processes. The possibilities for engineering new materials with unique or improved properties for a number of applications is now evident from the extant research results. A brief review is presented here along with some examples of useful application areas and some thoughts for the future of this field.

21560 (UCRL-JC–120324) **Analytical and numerical modeling of surface morphologies in thin films.** Genin, F.Y. Lawrence Livermore National Lab., CA (United States). May 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950412–18: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95014453. Source: OSTI; NTIS; GPO Dep.

Experimental studies have show that strains due to thermal expansion mismatch between a film and its substrate can produce very large stresses in the film that can lead to the formation of holes and hillocks. Based on a phenomenological description of the evolution of a solid surface under both capillary and stress driving forces and for surface and grain boundary self-diffusion, this article provides analytical and numerical solutions for surface profiles of model geometries in polycrystalline thin films. Results can explain a variety of surface morphologies commonly observed experimentally and are discussed to give some practical insights on how to control the growth of holes and hillocks in thin films.

3601 Metals and Alloys

Refer also to citation(s) 20826, 20830, 20970, 21070, 21084, 21115, 21224, 21226, 21229, 21506, 21636, 21651, 21759, 21784, 21833, 22041, 22102, 22119, 22455, 22791, 22808, 22872, 22873, 22929

21561 (ANL/CMT/AV–86434) **Script for Argonne lithium process video.** Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9506176–summ.: 19. annual actinide separations conference, Monterey, CA (United States), 12-15 Jun 1995). Order Number DE95013522. Source: OSTI; NTIS; INIS; GPO Dep.

Approximately 2700 metric tons of spent nuclear fuel, representing over 40 years of reactor research and development, has accumulated within the DOE complex. This fuel reflects the varied purposes of DOE reactors and covers a wide range of composition, enrichment, cladding, and chemical reactivity. The varied nature of these fuels complicates their long term disposal. To attempt to individually qualify each type for disposal in a repository would be prohibitively expensive. The electrometallurgical treatment technique, developed by Argonne National Laboratory, is designed to homogenize the wide variety of spent fuel types into a single set of acceptable disposal forms.

21562 (ANL/MSD/CP–83461) **The effect of displacement cascades on small helium bubbles in aluminum and gold.** Donnelly, S.E. (Salford Univ. (United Kingdom)); Valizadeh, R.; Vishnyakov, V.; Birtcher, R.C.; Templier, C. Argonne National Lab., IL (United States). Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States);North Atlantic Treaty Organization, Brussels (Belgium);Forskningsraadsnaemnden, Stockholm (Sweden). DOE Contract W-31-109-ENG-38. GRANT 910670; GRANT GR/H65320. (CONF-941144–147: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95007137. Source: OSTI; NTIS; GPO Dep.

The evolution of individual helium bubbles in thin foils of gold and aluminum irradiated with 400 keV Ar+ and 200 keV Xe+ has been followed with in-situ transmission electron microscopy for a comparison between the effects of dilute (Al) and dense (Au) collision cascades. Bubble shrinkage in Al has been attributed to direct displacement of the gas out of the bubbles. Effects in Au, include

the disappearance and Brownian motion of bubbles under irradiation, and are consistent with thermal spike processes seen in molecular dynamics simulations.

21563 (ANL/MSD/CP–86106) **Production of defects in metals by collision cascades: TEM experiments.** Kirk, M.A. Argonne National Lab., IL (United States). Mar 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9409349–1: International workshop on an assessment of fundamental aspects of radiation damage production and accumulation in metals and alloys, Obninsk (Russian Federation), 12-18 Sep 1994). Order Number DE95012460. Source: OSTI; NTIS; GPO Dep.

This paper reviews experimental TEM data on production of dislocation loops by low energy ion bombardment to low doses, as simulations of similar collision cascades produced by fast neutron irradiation, in various metals and alloys. The dependence of vacancy dislocation loop formation on recoil energy, sample temperature, and specific metal or alloy will be examined. Special emphasis will be placed on the effects of dilute alloy additions. A model for cascade melting will be employed to understand these effects, and will require an examination of the role of electron-phonon coupling in cascade cooling and recrystallization. The formation of interstitial dislocation loops as cascade defects, and the influence of the nearby surfaces in these experiments is briefly discussed.

21564 (CEA-CONF–11898) **Microstructure and grain boundary sliding influences on intergranular stress corrosion cracking of alloy 600.** Kergaravat, J.F.; Baillin, X. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. d'Etudes des Materiaux. 1994. 2p. (CONF-940766–: 13. international congress on electron microscopy, Paris (France), 17-22 Jul 1994). Order Number DE95630865. Source: OSTI; NTIS (US Sales Only); INIS.

Alloy 600 (NC15Fe) has been used for steam generator tubes of PWR reactors. In primary water, it is sensitive to an Intergranular Stress Corrosion Cracking (IGSCC) which mainly affects areas of high residual stresses. In order to study the influence of microstructure and grain boundary deformation, especially Grain Boundary Sliding (GBS), on IGSCC, specimens with different microstructures have been prepared from industrial alloys. GBS measurements are carried out on strained specimens by SEM with a microgrid technique. Conventional and in situ TEM experiments are proceeded to study the deformation in the grain boundary area and the dislocation/precipitation interactions. (authors). 3 figs.

21565 (CONF-9406335–1) **Patterns and perspectives in applied fracture mechanics.** Merkle, J.G. Oak Ridge National Lab., TN (United States). [1994]. 39p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement 1886-8011-9B. From 26. national symposium on fracture mechanics; Idaho Falls, ID (United States); 28-30 Jun 1994. Order Number DE95012844. Source: OSTI; NTIS; GPO Dep.

This lecture begins with a overview of applied fracture mechanics pertinent to safety of pressure vessels. It then progresses to a chronological panorama of experimental and analytical results. To be useful and dependable in safety analysis of real structures, new analysis developments must be physically realistic, which means that they must accurately describe physical cause and effect. Consequently, before mathematical modeling can begin, cause and effect must be established from experimental data. This can be difficult and time consuming, but worth the effort. Accordingly, the theme of this paper is that the search for patterns is constant and vital. This theme is illustrated by the development of small, single-specimen, fracture toughness testing techniques. It is also illustrated by the development, based on two different published large-strain, elastic-plastic, three-dimensional finite-element analyses, of a hypothesis concerning three-dimensional loss of constraint. When a generalization of Irwin's thickness-normalized plastic-zone parameter, reaches a value close to 2π, the through-thickness contraction strain at the apex of the near-tip logarithmic-spiral slip-line region becomes the dominant negative strain accommodating crack opening. Because slip lines passing from the midplane to the stress-free side surfaces do not have to curve, once these slip lines are established, stresses near the crack tip are only elevated by strain hardening and constraint becomes significantly relaxed. This hypothesis, based on published three-dimensional elastic-plastic analyses, provides a potentially valuable means for gaining additional insight into constraint effects on fracture toughness by considering the roles played by the plastic strains as well as the stresses that develop near a crack tip.

21566 (CONF-9410290–5) **Fracture behavior of bainitic chromium-tungsten and chromium-molybdenum steels.** Klueh, R.L.; Alexander, D.J.; Maziasz, P.J. Oak Ridge National Lab., TN (United States). [1994]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 36. mechanical working and steel processing conference; Baltimore, MD (United States); Oct 1994. Order Number DE95013206. Source: OSTI; NTIS; GPO Dep.

Bainitic microstructures formed during continuous cooling of low-carbon alloy steels often appear different from classical upper and lower bainite developed by isothermal transformation. The kind of non-classical bainite produced during transformation determines the fracture behavior in a Charpy impact test. Quenching and normalizing treatments of a 3Cr-1.5Mo-0.25V-0.IC steel gave two different bainitic microstructures: a carbide-free acicular structure formed during quenching and a granular bainite formed during normalizing. The superior impact toughness of the quenched steel over the normalized steel was attributed to the difference in microstructure. A similar observation on microstructure was made for a 2.25Cr-2W-0.1C and a 2.25Cr-2W-0.25V-0.IC steel. These observations were used to develop new Cr-W steels with improved strength and impact toughness.

21567 (CONF-941144–154) **Melting, casting, and processing of nickel and iron aluminides.** Sikka, V.K. Oak Ridge National Lab., TN (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95008970. Source: OSTI; NTIS; GPO Dep.

A process for successful melting of Ni_3Al- and Fe_3Al-base alloys is described. Casting and welding of these alloys are also briefly described.

21568 (CONF-941144–158) **Static displacements of atoms in crystalline metallic solid solutions.** Sparks, C. (Oak Ridge National Lab., TN (United States)); Ice, G.; Jiang, X.; Zschack, P. Oak Ridge National Lab., TN (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95012893. Source: OSTI; NTIS; GPO Dep.

Measurement of diffuse x-ray scattering from binary crystalline solid solutions at more than one x-ray energy is a sensitive probe of the average interatomic distance between neighboring pairs of atoms. Deviations of these bond distances by as little as 0.001 Å are easily detected in the diffuse scattering from binary alloys consisting of atoms nearby in the periodic table and/or where x-ray energies chosen near their absorption edges can change the scattering contrast. Individual bond distances (AA, AB and BB) are recovered out to several near neighbor shells by combining three scattering measurements at x-ray energies chosen for maximum and minimum contrast. Average bond distances recovered from four metal alloys $Fe_{77.5}Ni_{22.5}$, $Fe_{46.5}Ni_{53.5}$, $Cr_{47}Fe_{53}$ and $Cr_{20}Ni_{80}$ are discussed. The authors find that the interatomic distances measured for these alloys give interesting insights to atomic displacements in solid solutions. Nearest neighbor bond distances are not well represented by phenomenological models based on pure element atomic size and concentration dependence of the lattice constants. Radial and nonradial displacements are recovered from these measurements of diffuse scattering.

21569 (CONF-9504168–1) **Embrittlement of austenitic stainless steel welds.** David, S.A.; Vitek, J.M.; Alexander, D.J. Oak Ridge National Lab., TN (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Department of Energy/Electric Power Research Institute/National Institute of Standards and Technology (DOE/EPRI/NIST) workshop; Charlotte, NC (United States); 11-13

Apr 1995. Order Number DE95013046. Source: OSTI; NTIS; INIS; GPO Dep.

To prevent hot-cracking, austenitic stainless steel welds generally contain a small percent of delta ferrite. Although ferrite has been found to effectively prevent hot-cracking, it can lead to embrittlement of welds when exposed to elevated temperatures. The aging behavior of type-308 stainless steel weld has been examined over a range of temperatures 475–850 C for times up to 10,000 hrs. Upon aging, and depending on the temperature range, the unstable ferrite may undergo a variety of solid state transformations. These phase changes creep-rupture and Charpy impact properties.

21570 (CONF-9507128–1) **On the expansion for surface displacement in the neighborhood of a crack tip.** Gray, L.J. (Oak Ridge National Lab., TN (United States)); Paulino, G.H. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From IABEM '95: international symposium on boundary element methods; No City Given, HI (United States); Jul 1995. Order Number DE95012890. Source: OSTI; NTIS; GPO Dep.

It is shown that in the expansion of the crack opening displacement vs distance from the tip, there is no linear term present. This should lead to improved accuracy of the near tip fields and improved stress intensity factor results. The two-dimensional discussion should be able to be carried over to three dimensions.

21571 (CONF-950892–3) **Ionization delocalization and ALCHEMI of B2-ordered alloys.** Anderson, I.M.; Bentley, J. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. From 53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95012847. Source: OSTI; NTIS; GPO Dep.

Purpose of this paper is to demonstrate that the major assumption underlying the ALCHEMI formulation is justified: that the degree of ionization localization of an elemental shell can be accounted for by a linear coefficient; and to introduce a potential method, which would be applicable to B2-ordered alloys, of independently extracting the ratio of coefficients L_{jk} necessary for delocalization correction. A Cr-doped FeAl alloy and a series of Fe-doped NiAl alloys with 0.25-12 at. % Fe were analyzed. Excellent linearity of the data substantiates the use of linear coefficients to model ionization localization. It was investigated whether the L_{jk} acquired at a (110) systematics orientation could be accurately applied to ALCHEMI data acquired at (200).

21572 (CONF-950892–4) **A systematic ALCHEMI study of Fe-doped NiAl alloys.** Anderson, I.M. (Oak Ridge National Lab., TN (United States)); Bentley, J.; Duncan, A.J. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. From 53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95012848. Source: OSTI; NTIS; GPO Dep.

ALCHEMI site-occupation studies of alloying additions to ordered aluminide intermetallic alloys have been performed with varying degrees of success, depending on the ionization delocalization correction. This study examines the variation in the site-occupancy of Fe in B2-ordered NiAl vs solute concentration and alloy stoichiometry. The fraction of Fe on the 'Ni' site is plotted vs Fe concentration. The good separation among the data from alloys of the three stoichiometries shows that the site occupancy of iron depends on the relative concentrations of the Ni and Al host elements; however a preference for the 'Ni' site is clearly indicated.

21573 (CONF-9509118–5) **Towards predicting weld metal microstructure from fundamentals of transport phenomena.** Mundra, K. (Pennsylvania State Univ., University Park, PA (United States)); DebRoy, T.; Babu, S.S.; David, S.A.; Paul, A.J. Oak Ridge National Lab., TN (United States); Pennsylvania State Univ., University Park, PA (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER45158 ; AC05-84OR21400. From Modeling of casting, welding and advanced solidification processes 7; London (United Kingdom); 10-15 Sep 1995. Order Number DE95012299. Source: OSTI; NTIS; GPO Dep.

Heat transfer and fluid flow during manual metal arc welding Of low alloy steels were investigated by solving the equations of conservation of mass, momentum and energy in three dimensions. Calculated cooling rates were coupled with an existing phase transformation model to predict the microstructure in low alloy steel welds. The computed results were found to be in good agreement with experimentally observed microstructures. The agreement indicates significant promise for predicting spatial distribution of weld metal microstructure from the fundamentals of transport phenomena.

21574 (DOE/ER–45372-8) **Metal-ceramic interfaces: Overlayer-induced reconstruction and magnetism of 4d transition-metal monolayers.** Wu, R.; Freeman, A.J. Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy. 15 Feb 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45372. Order Number DE95011543. Source: OSTI; NTIS; GPO Dep.

Structural, electronic, and magnetic properties of metal-ceramic interfaces, M/MgO(001) (M=Pd, Rh, and Ru), have been investigated using the full potential linearized augmented-plane-wave method. Ru and Rh monolayers are found to be able to retain large spin magnetic moments on MgO(001) (1.95 μ_B and 1.21 μ_B for Ru and Ph; respectively) – indicating, in principle, the potential application of MgO(001) as a benign substrate for 4d monolayer magnetism. Significantly, according to our atomic-force determinations, the metal overlayers induce a sizable buckling reconstruction in the interfacial MgO layer, which enhances the M-MgO binding energy by 0.1 eV. The weak M-0 interaction is mainly via tail effects; however, it affects the density of states at the Fermi level for Pd/Mg0(001) significantly and completely eliminates the small magnetic moment of the free Pd monolaver (0.34μ_B).

21575 (DOE/ID/13220–T4) **Magnetically controlled deposition of metals using gas plasma. Quarterly progress report, January–March, 1995.** Idaho Univ., Idaho Falls, ID (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-93ID13220. Order Number DE95012414. Source: OSTI; NTIS; GPO Dep.

The objective of the grant is to develop a method of spraying materials on a substrate in a controlled manner to eliminate the waste inherent in present plating processes. The process under consideration is magnetically controlled plasma spraying. The project continues to be on schedule. The field equations have been developed and were reported in the April–June 1994 Progress Report. The equations for the external magnetic field were reported in the July–September 1994 progress report. The field equations have been cast in a format that allows solution using Finite Element (FE) techniques. The development of the computer code that will allow evaluation of the proposed technique and design of an experiment to prove the proposed process is underway. The basic numerical technique was reported in the October–December 1994 progress report, and code development and verification are underway (see Attachment 1).

21576 (DOE/ID/13230–T1) **Advanced precision expendable pattern casting technology. 1994 Summary report.** Alabama Univ., Birmingham, AL (United States). Dept. of Materials Science and Engineering. May 1995. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-93ID13230. Order Number DE95012200. Source: OSTI; NTIS; GPO Dep.

Casting technology is described. The following areas are reported on: precision pattern production; pattern coating; sand fill and compaction; pattern gating; mechanical properties; and technology transfer efforts.

21577 (EGG-SE–6683) **Technical development of double-clad process for thin strip casting of carbon steel.** Brown, H.L.; Forkel, C.E.; Knudson, D.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1984. 377p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE95011406. Source: OSTI; NTIS; GPO Dep.

This report documents the technical development for a patent disclosure of a double-clad process for the continuous casting of

thin-strip carbon steel. The fundamental idea of the disclosure is to form a product strip by depositing molten steel between two, cooled, clad strips of the same material. The claimed benefits include: (a) the conservation of energy in steel making through the elimination of soaking pits and reheat cycles, and (b) an improved surface on both sides of the as-cast product such that it will be suitable for direct feed to a cold-reduction mill. However, the process as conceived is not necessarily limited to the casting of carbon steel, but may be also applied to other metals and alloys. The work is described under three headings as follows. Preliminary Considerations and Scoping Analysis presents the basic idea of the double-clad, thin-strip casting process; the energy conservation potential; scoping heat transfer calculations for the casting process; and independent review of this work. Thermal Analysis for Roller Configuration of Double-Clad Process, presents the development, results, and independent review of a finite-element thermal analysis for the casting process as originally conceived (using only chilled rollers in direct contact with the clad material of the product strip). Further Considerations for Belt Configuration of Double-Clad Process deals with a modified equipment design which interposes two product support belts, one on each side of the product, between the clad strip and the rollers. In addition to the process description, this section presents the preliminary mechanical calculations for the endless metal belts and the work scope and results for the computer model revision and thermal analysis for the modified concept.

21578 (FEI–2372) **Nitrogen effect on crystal lattice dynamics in austenitic steel type Kh18AG19.** Danilkin, S.A.; Beskrovnyj, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 21p. (In Russian). Order Number DE95633059. Source: OSTI; NTIS (US Sales Only); INIS.

The inelastic neutron scattering study of Fe-18Cr-19Mn alloy with nitrogen content between 1.5-3.7 at% is presented. The nitrogen content dependencies of lattice parameter and frequency spectrum are obtained. The metal atom spectrum depends only slightly on nitrogen content with mean parameters $<\epsilon>$ and $<\epsilon^2>$ unchanged. The effect of Me-Me interaction decrease caused by lattice dilation on $<\epsilon^2>$ is compensated by Me-N interaction. The nitrogen atoms frequencies are linear with lattice parameter for Fe-18Cr-19Mn and Fe-18Cr-10Mn-15Ni alloys. 13 refs.; 10 figs.; 3 tabs.

21579 (FEI–2413) **Study of oxygen influence on sodium surface tension.** Berenskij, L.L.; Ivanovskij, M.N.; Loginov, N.I.; Mikheev, A.S.; Morozov, V.A.; Shimkevich, A.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 8p. (In Russian). Order Number DE95633088. Source: OSTI; NTIS (US Sales Only); INIS.

The results of experimental study of oxygen affect on the Kh18n10t steel wettability and sodium surface tension are presented. Oxygen dissolved in sodium in the concentration up to 30 ppm does not decrease capillary stress in a capillary-porous structure and accelerates its surface wettability. 10 refs.; 2 figs.; 2 tabs.

21580 (FEI–2415) **On the structure of molecular dynamic model of liquid potassium.** Kuzin, V.V.; Morozov, V.A.; Shimkevich, A.L.; Shimkevich, I.Yu. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 18p. (In Russian). Order Number DE95633060. Source: OSTI; NTIS (US Sales Only); INIS.

Momentary and thermally relaxed structure of molecular dynamics model of liquid potassium has been examined within the framework of statistical geometry. It has been shown that dense part of liquid matrix is constructed with slightly distorted tetrahedral local atomic configurations. Such tetrahedra trend to aggregate sharing common faces. Scaling behaviour of clusters can be the evidence of their fractal-similar geometry. 15 refs.; 10 figs.

21581 (INIS-JP–028, pp. 112-114) **Relation between electrical resistivity and argon concentration of copper thin films prepared by ion-beam-assisted deposition.** Gotoh, Yasuhito (Kyoto Univ. (Japan). Dept. of Electronics); Yoshii, Hideki; Amioka, Takao; Kameyama, Koji; Tsuji, Hiroshi; Ishikawa, Junzo. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

Particle Induced X-ray Emission (PIXE) measurements were applied to the evaluation of the argon concentration in the copper thin films prepared by Ion-Beam-Assisted Deposition (IBAD) technique. The relation between electrical resistivity and argon concentration in the films were investigated. The crystallinity and the atomic density were also examined with x-ray diffraction and Rutherford Backscattering Spectrometry (RBS). The obtained results indicated that although the grain size of the films becomes larger with the ion irradiation, electrical resistivity increases with an increase in the ion quantity. (author).

21582 (IS-T–1714) **Optical anisotropy of (110) surfaces of Ag and Cu.** Chen, Zai. Ames Lab., IA (United States); Iowa State Univ. of Science and Technology, Ames, IA (United States). 20 Oct 1994. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE95010130. Source: OSTI; NTIS; GPO Dep.

A reflectance-difference spectroscopy (RD) system was designed and built to study the anisotropic optical response of the (110) surfaces of silver and copper. Results of the RD spectra are described.

21583 (JFP–18) **Extrusion of I&E "O" size tubing to finalize the process. Experiment No. U-31.** Frazier, D.S.; Puterbaugh, J.F. Bridgeport Brass Co., Adrian, MI (United States). 3 Feb 1961. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. A.E.C. Contract Number AT-(30-1)-1405. Order Number DE95012632. Source: OSTI; NTIS; GPO Dep.

Work has been progressing on the development of an extrusion process for I&E tubing. The ultimate object of this development project is to compare the extrusion process from a cost standpoint with, the presently used rolling-drilling process. Various experiments have been performed to determine the optimum billet I.D., the proper follower block technique, the proper tooling parameters for the process, and the proper metallurgical structure of the material for optimum results. This extrusion combines many of the past results as a further determination and refinement of the extrusion process to be used in the final semi-production optimization extrusion. The object of this extrusion was to evaluate the resulted of previous extrusion experiments to determine final process conditions prior to an optimization extrusion.

21584 (LA-UR–95-739) **High strain rate deformation of Ti-48Al-2Cr-2Nb in the duplex morphology.** Maloy, S.A.; Gray, G.T. III. Los Alamos National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950201–15: Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS), Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95007852. Source: OSTI; NTIS; GPO Dep.

The compressive deformation behavior of Ti-48Al-2Nb-2Cr in the duplex microstructural morphology has been studied at strain rates of 0.001/s and 2000/s over the temperature range from -196 to 1100°C. The material was cast, homogenized, extruded and heat treated to obtain the duplex microstructure. The yield stress is strain rate sensitive at 25°C and increases with temperature at a strain rate of 2000/s from 500 to 1100°C. TEM investigations reveal that deformation occurs in γ-TiAl by means of [111]<112> twinning, 1/2<110> slip, and <101> superdislocations under all conditions depending on the orientation of the grain with respect to the deformation axis. Optical metallography reveals that twinning increases with increasing strain rate. TEM results revealing the dislocation substructure are used to explain the yield stress anomaly.

21585 (LA-UR–95-1319) **Development of local shear bands and orientation gradients in fcc polycrystals.** Beaudoin, A.J. Jr. (Reynolds Metals Co., Richmond, VA (United States)); Mecking, H.; Kocks, U.F. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. N00014-90-J-1810. (CONF-9506144–6: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United

States), 18-21 Jun 1995). Order Number DE95012072. Source: OSTI; NTIS; INIS; GPO Dep.

A finite element formulation which derives constitutive response from crystal plasticity theory is used to examine localized deformation in fcc polycrystals. The polycrystals are simple, idealized arrangements of grains. Localized deformations within individual grains lead to the development of domains that are separated by boundaries of high misorientation. Shear banding is seen to occur on a microscopic scale of grain dimensions. The important consequences of these simulations are that the predicted local inhomogeneities are meeting various requirements which make them possible nucleation sites for recrystallization.

21586 (LA-UR–95-1320) **Magnetoresistance behavior of UNiGe.** Nakotte, H. (Los Alamos National Lab., NM (United States)); Lacerda, A.; Purwanto, A.; Havela, L.; Sechovsky, V.; Prokes, K.; Brueck, E.; Boer, F.R. de; Torikachvili, M.S. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);U.S. Czechoslovak Science and Technology Joint Fund (United States). DOE Contract W-7405-ENG-36. (CONF-9505186–2: 2. physical phenomena at high magnetic fields conference, Tallahassee, FL (United States), 6-9 May 1995). Order Number DE95012071. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have measured the temperature dependences of the magnetoresistance of single-crystalline UNiGe for both parallel (i/B//c-axis) and perpendicular configurations (i//a-axis, B//c-axis) in magnetic fields up to 18 T. Both configurations yield similar magnetoresistance behavior, which emphasizes the strong magnetic contribution to the resistivity in all directions. Crossing magnetic-phase boundaries causes anomalies in the magnetoresistance, which allowed a completion of the previously proposed magnetic phase diagram.

21587 (NUREG/CR–6275) **Mechanical properties of thermally aged cast stainless steels from Shippingport reactor components.** Chopra, O.K. (Argonne National Lab., IL (United States)); Shack, W.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering Technology; Argonne National Lab., IL (United States). Apr 1995. 155p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (ANL–94/37). Source: OSTI; NTIS; GPO; INIS.

Thermal embrittlement of static-cast CF-8 stainless steel components from the decommissioned Shippingport reactor has been characterized. Cast stainless steel materials were obtained from four cold-leg check valves, three hot-leg main shutoff valves, and two pump volutes. The actual time-at-temperature for the materials was ~13 y at ~281 C (538 F) for the hot-leg components and ~264 C (507 F) for the cold-leg components. Baseline mechanical properties for as-cast material were determined from tests on either recovery-annealed material, i.e., annealed for 1 h at 550 C and then water quenched, or material from the cooler region of the component. The Shippingport materials show modest decreases in fracture toughness and Charpy-impact properties and a small increase in tensile strength because of relatively low service temperatures and ferrite content of the steel. The procedure and correlations developed at Argonne National Laboratory for estimating mechanical properties of cast stainless steels predict accurate or slightly lower values for Charpy-impact energy, tensile flow stress, fracture toughness J-R curve, and J_{IC} of the materials. The kinetics of thermal embrittlement and degree of embrittlement at saturation, i.e., the minimum impact energy achieved after long-term aging, were established from materials that were aged further in the laboratory. The results were consistent with the estimates. The correlations successfully predicted the mechanical properties of the Ringhals 2 reactor hot and crossover-leg elbows (CF-8M steel) after service of ~ 15 y and the KRB reactor pump cover plate (CF-8) after ~ 8 y of service.

21588 (PNL-SA–26120) **Implications of early stages in the growth of stress corrosion cracking on component reliability.** Jones, R.H.; Simonen, E.P. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504156–1: Research Assistant Task Force conference, Charlotte, NC (United States), 11-13 Apr 1995). Order Number DE95011498. Source: OSTI; NTIS; GPO Dep.

Environment-induced crack growth generally progresses through several stages prior to component failure. Crack initiation, short crack growth, and stage 1 growth are early stages in crack development that are summarized in this paper. The implications of these stages on component reliability, derive from the extended time that the crack exists in the early stages because crack velocity is slow. The duration of the early stages provides a greater opportunity for corrective action if cracks can be detected. Several important factors about the value of understanding short crack behavior include: (1) life prediction requires a knowledge of the total life cycle of the crack including the early stages, (2) greater reliability is possible if the transition between short and long crack behavior is known component life after this transition is short and (3) remedial actions are more effective for short than long cracks.

21589 (SAND–95-0855C) **Qualification of environmentally friendly cleaners.** De Marquis, G.; Lopez, E.P. Sandia National Labs., Albuquerque, NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9503119–4: ECM '95 conference, Las Cruces, NM (United States), 12-15 Mar 1995). Order Number DE95011873. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories (SNL) has traditionally used chlorinated and fluorinated organic solvents for general degreasing applications. Many of these solvents have been labeled by the Federal Government as ozone depleting chemicals and as toxic and/or suspected carcinogens. As a result, these solvents will no longer be recommended for use within the DOE weapons complex. There are three major classes of materials that are of concern for cleaning: organics, metals and ceramics. Each of these materials has its own special cleaning problems. Solvents that were used in the past, such as 1,1,1-trichloroethane (TCA) and trichloroethylene (TCE), were extremely efficient at removing everything from oils and greases to salts without leaving corrosive residues or permanently absorbing into the materials. These traditional degreasing solvents were essentially "all-inone" cleaners: quick, reliable, and easy to use. Unfortunately, a "drop-in" cleaner for such a wide variety of materials and contaminants will probably never be identified. So far, it has been difficult to identify environmentally conscious cleaners that clean as well as TCE and TCA. Most alternative cleaners require more volume to do the job, and also require longer exposure to get the job done. With these things in mind, we are hoping to identify and qualify new cleaners that will take care of general classes of materials.

21590 (SAND–95-0885) **Capacitive sensor for high resolution weld seam tracking.** Schmitt, D.J.; Novak, J.L.; Akins, J.L. Sandia National Labs., Albuquerque, NM (United States). May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011833. Source: OSTI; NTIS; GPO Dep.

A non-contact capacitive sensing system has been developed for guiding automated welding equipment along typical v-groove geometries. The Multi-Axis Seam Tracking (MAST) sensor has been designed to produce four electric fields for locating and measuring the v-groove geometry. In this system, the MAST sensor is coupled with a set of signal conditioning electronics making it possible to output four varying voltages proportional to the electric field perturbations. This output is used for motion control purposes by the automated welding platform to guide the weld torch directly over the center of the v-groove. This report discusses the development of this capacitive sensing system. A functional description of the system and MAST sensor response characteristics for typical weld v-groove geometries are provided. The effects of the harsh thermal and electrical noise environments of plasma arc welding on sensor performance are discussed. A comparison of MAST sensor fabrication from glass-epoxy and thick-film ceramic substrates is provided. Finally, results of v-groove tracking experiments on a robotic welding platform are described.

21591 (SAND–95-8507C) **Numerical simulation and experimental observations of initial friction transients.** Hughes, D.A.; Weingarten, L.I.; Dawson, D.B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506144–8: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United States), 18-21 Jun 1995). Order Number DE95014250. Source: OSTI; NTIS; GPO Dep.

Experiments were performed to better understand the sliding frictional behavior between metals under relatively high shear and normal forces. Microstructural analyses were done to estimate local near-surface stress and strain gradients. The numerical simulation of the observed frictional behavior was based on a constitutive model that uses a state variable approach.

21592 (SAND–95-8551C) **Super-leidenfrost spray cooling: A solution to the problem of controlled high-temperature, high-flux heat extraction.** Edwards, C.F.; Hahn, D.W. Sandia National Labs., Livermore, CA (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505212–1: ILASS Americas '95: 8. annual conference on liquid atomization and spray system, Troy, MI (United States), 21-24 May 1995). Order Number DE95010758. Source: OSTI; NTIS; GPO Dep.

Our interest in spray cooling stems from a problem in high-temperature materials synthesis. Specifically, it is the growth of diamond films by flame chemical vapor deposition (CVD). A high velocity jet of premixed $C_2H_2/O_2/H_2$ is formed into a stagnation point flow over the surface of a molybdenum mandrel causing the formation of a highly strained flame immediately adjacent to the surface. The difficulty that arises is that concomitant with the flux of energetic species to the surface is a large flux of heat which must be removed from the mandrel if control of the growth process is to be maintained. The situation is further complicated by the fact that the deposition surface temperature must be held to a tight tolerance somewhere within the optimal diamond growth range (~1200 K) and the heat extraction must be made in a one-dimensional fashion to preserve the uniform boundary condition on the flame. Since the cooling surface temperature is fixed near the saturation condition by the phase change of the droplets, and the heat flux into the mandrel is imposed by the flame, the only way to achieve a desired deposition surface temperature is to vary the thermal resistance of the mandrel itself. Since the cooling surface is isothermal, uniform temperature at the deposition surface will only result if the heat flux through the mandrel is uniform, that is, if the sides of the mandrel are effectively adiabatic and the flame is uniform over the mandrel surface. If either of these conditions is not met, the deposition surface temperature cannot be made uniform using this method. These limitations could be overcome if it were possible to carry out the spray cooling process without being tied to the isothermal boundary condition inherent in phase-cooling. Such a solution exists for spray cooling above the Leidenfrost temperature; that is the subject of this paper – super-Leidenfrost spray cooling.

21593 (SAND–95-8554C) **Printability of substrate and absorber defects on extreme ultraviolet lithographic masks.** Nguyen, K.B. (Sandia National Labs., Livermore, CA (United States)); Ray-Chaudhuri, A.K.; Tichenor, D.A.; Stulen, R.H.; Nissen, R.P.; Berger, K.W.; Paul, P.H.; Tennant, D.M.; Fetter, L.A.; Windt, D.L. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950226–47: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95010916. Source: OSTI; NTIS; GPO Dep.

This paper reports results from a study of defect printability for extreme ultraviolet lithographic masks (EUVL). Imaging experiments were performed with an EUVL mask containing programmed defects. The mask contained defects of different sizes and locations with respect to the absorber patterns. Since an EUVL mask consists of absorber layer patterned above a multilayer-coated substrate, both substrate defects, located below the reflective coating, and absorber defects, located above the reflective coating, were included on the programmed defect mask. The absorber layer was patterned using a process previously described by Tennant et al. Imaging was performed using a 10X Schwarzschild camera operating at 13.4 nm with a numerical aperture of 0.08, corresponding to a Rayleigh resolution of 0.1 gm. This system has an effective exposure field of 0.4 mm diameter. Both positive-tone and negative-tone resists were used. Measurements of the defect-induced linewidth variations on the printed resist lines were performed with scanning electron microscopy (SEM) and atomic force microscopy (AFM). Results show that substrate defects are more printable compared to defects of the same sizes located above the reflective coating. In addition, defects located in the center of a clear region in lines-and-space pattern are more printable compared to those located nearer to the absorber lines.

21594 (TKK-V–B82) **Computer simulation of gas flow in the flash smelting furnace.** Jokilaakso, A.; Yang, Yongxiang; Teppo, O.; Ahokainen, T.; Haenninen, A. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Materials Processing and Powder Metallurgy. 1993. 56p. Project KTM-SULA 10. Order Number DE95779270. Source: OSTI; NTIS.

SULA2 Research Programme.

This report presents the detailed results of computer simulation of flow in the Outokumpu flash smelting furnace. The work belongs to the project SULA-10: 'Reaction and flow dynamic modelling of suspension smelting technology', and was carried out in Laboratory of Materials Processing and Powder Metallurgy at Helsinki University of Technology. The geometry of the flash smelting furnace was simulated with a laboratory scale water and gas models. The same geometry was created as computational grids, in which the flow situation was analysed. The results from the laboratory models and computational grids were found to be in good agreement. The computer simulation was then extended to an industrial-scale flash smelting furnace. Cold gas flow was analysed in order to obtain a general flow pattern and working computational grid for future work with heat transfer, two-phase flow and chemical reactions. The computation was carried out with PHOENICS-based software EasyFlow and CFD2000. (orig.)

21595 (TKK-V–B94) **Flow and heat transfer simulation in a flash smelting furnace.** Ahokainen, T.; Jokilaakso, A.; Teppo, O.; Yang, Yongxiang. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Materials Processing and Powder Metallurgy. 1994. 36p. Order Number DE95779247. Source: OSTI; NTIS.

Fluid flow and heat transfer phenomena taking place in an industrial Outokumpu type flash smelting furnace were simulated with CFD software CFD2000 1.0 and PHOENICS 1.6.6. The computational domains and grids are basically the same as described in earlier reports. However, some changes and simplifications are made to the grids,especially in the reaction shaft model. The standard k-ϵ turbulence model and the six-flux radiation model were applied to the relevant flow and heat transfer computations. Both the Lagrangian and Eulerian treatment were used in two-phase flow calculations to describe the particle phase. All the two-phase simulations presented in this report are cold and isothermal, where the particles exchange only momentum with the gas phase. As a first attempt, combustion of gaseous sulphur with oxygen was used to represent the heat release from the copper concentrate oxidation reactions. The results presented in this report are preliminary reflecting the different stages of the model development. (orig.)

21596 (UCRL-ID–116849) **A solidification constitutive model for NIKE2D and NIKE3D.** Raboin, P.J. Lawrence Livermore National Lab., CA (United States). 17 Mar 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012103. Source: OSTI; NTIS; GPO Dep.

This memo updates the current status of a solidification material model development which has been underway for more than a year. Significant modeling goals such as predicting cut-off stresses, thermo-elasto-plasticity, strain rate dependent plasticity and dynamic recovery have been completed. The model is called SOLMAT for solidification material model, and while developed for NIKE2D, it has already been implemented in NIKE3D and NIT03D by B. Maker. This memo details the future development strategy of SOLMAT including liquid and solid constitutive improvements, coupling of deviatoric and dilatational deformation and a plan to switch between constitutive theories. It explains some of the difficulties associated solidification modeling and proposes two experiments to measure properties for using SOLMAT. Due to the sensitive nature

of these plans in relation to programmatic and CRADA concerns, this memo should be treated as confidential document.

21597 (UCRL-ID–119335) **Concurrent solid state diffusion bonding and superplastic forming of aluminum alloy 7475.** Sunwoo, A.; Lum, R.; Vandervoort, R. Lawrence Livermore National Lab., CA (United States). Jan 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013290. Source: OSTI; NTIS; GPO Dep.

Earlier studies on diffusion bonding (DB) of Al alloys have focused mostly in extrinsically changing the bonding conditions through the use of interlayers, surface etching, or environment. The problem with focusing on the extrinsic conditions only is that the benefits of the DB process are not fully utilized and instead, it can create problems for the base alloy. The approach we have taken to study solid state diffusion bondability of Al alloy is to utilize the intrinsic behavior of superplastic material. Beginning with this preprocessed material, we used a unique method, to obtain diffusion bonding concurrently with superplastic forming to achieve ductile, oxide-free bonds at significantly lower pressures and temperature in an argon atmosphere.

21598 (UCRL-ID–119964) **Machinability study of Aermet 100.** Squire, D.V.; Syn, C.K.; Fix, B.L. Lawrence Livermore National Lab., CA (United States). 8 Feb 1995. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. MIPR No. N62269/94/MR/00307. Order Number DE95011532. Source: OSTI; NTIS; GPO Dep.

Machinability of Aermet 100, an ultrahigh strength alloy developed for Navy by Carpenter Technology as a candidate material for aircraft landing gear application, was studied by performing single-point turning tests. Coated and uncoated carbides, ceramic, and cermet cutting tool inserts of a square geometry (SNG 432 type) were used. Round stock workpieces were tested in the as - received, unaged condition and without using any cutting fluid. The turning tests for each tool material were conducted by (i) first establishing the cutting conditions that would allow the continued generation of broken chips during a given cutting test, (ii) measuring intermittently the flank wear as a function of cutting time under such established cutting conditions for discontinuous broken chips, and (iii) determining the tool life using the criteria specified in the ISO Standard 3685: 1993(E). Cutting tools except some uncoated carbide and ceramic were used with a mechanical chip breaker to induce chip breakage and avoid the generation of long continuous chips. The results obtained include the optimal cutting conditions for discontinuous chips, tool wear - cutting time curves, and records of tool life and tool failure mode for each tool material. From the measured tool life and cutting conditions, the amount of material removed by each cutting material was calculated. Coated carbide with CVD tri-phase coating showed the longest tool life that exceeded the twelve minute criterion and removed the highest amount of material per tool. Other tools failed by cutting edge chipping and their lives were shorter.

21599 (UCRL-ID–120611) **Electrodeposited tungsten-nickel-boron: A replacement for hexavalent chromium.** Steffani, C.; Meltzer, M. Lawrence Livermore National Lab., CA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011809. Source: OSTI; NTIS; INIS; GPO Dep.

Chromium, deposited from acidic solutions of its hexavalent ion, has been the rule for wear resistant, corrosion resistant coatings for many years. Although chromium coatings are durable, the plating process generates air emissions, effluent rinse waters, and process solutions that are toxic, suspected carcinogens, and a risk to human health and the environment. Tungsten-nickel-boron (W-Ni-B) alloy deposition is a potential substitute for hexavalent chrome. It has excellent wear, corrosion, and mechanical properties and also may be less of an environmental risk. This study examines the electroplating process and deposit properties of W-Ni-B and compares them with those of hexavalent chrome.

21600 (UCRL-JC–117773) **3D metal forming applications of ALE techniques.** Couch, R.; McCallen, R.; Otero, I.; Sharp, R. Lawrence Livermore National Lab., CA (United States). 27 Jan 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506144–3: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United States), 18-21 Jun 1995). Order Number DE95011745. Source: OSTI; NTIS; GPO Dep.

A three-dimensional arbitrary Lagrange-Eulerian (ALE) code is being developed for use as a general purpose tool for metal forming analyses. The focus of the effort is on the processes of forging, extrusion, casting and rolling. The ALE approach was chosen as an efficient way to deal with the large deformations and complicated flows associated with these processes. A prototype version of the software package, ALE3D, exists and is being applied to the enumerated processes. It is a finite element code which treats fluid and elastic-plastic response on an unstructured mesh. The prototype version includes heat transfer and the option of either implicit or explicit time integration of the dynamic equations. The status of the code is described. Several examples of application of the code to typical forming simulations are presented with discussions of the advantages and disadvantages of the ALE approach.

21601 (UCRL-JC–117980) **Analysis of interaction phenomena between liquid jets and materials.** Kang, Sang-Wook; Reitter, T.; Carlson, G. Lawrence Livermore National Lab., CA (United States). Feb 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950853–1: ASME/JSME annual summer meeting of the Fluids Engineering conference, Hilton Head, SC (United States), 13-17 Aug 1995). Order Number DE95010747. Source: OSTI; NTIS; GPO Dep.

The interaction phenomena of high-velocity liquid jets impinging on a material surface have been investigated theoretically and experimentally to gain an understanding of the physical mechanisms involved in material removal by fluidjet machining processes. Experiments were performed to determine conditions under which the liquid jet impacting a solid material will cause material removal and also to delineate possible physical mechanisms of mass removal at optimum jet-cutting conditions. We have also carried out numerical simulations of jet-induced surface pressure rises and of the material deformation and spallation behavior due to multiple droplet impacts. Results obtained from the experiments and theoretical calculations and their physical implications are also discussed.

21602 (UCRL-JC–119951) **Finite-element analysis of earing using non-quadratic yield surfaces.** Logan, R.W. Lawrence Livermore National Lab., CA (United States). 18 Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506144–2: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United States), 18-21 Jun 1995). Order Number DE95011429. Source: OSTI; NTIS; GPO Dep.

During deep draw cupping, the phenomenon known as earing may occur as the cup wall is formed, resulting in a periodic variation of cup wall height around the perimeter of the finished cup. This is generally due to planar anisotropy of flow in rolled sheet product. It is generally observed that the anisotropy parameter R will vary in the plane of the sheet when ears are observed in cupping, with a parameter ΔR describing the variation of R in the plane of the sheet. For many common textures in face-centered and body-centered materials, the ears form relative to the sheet rolling direction at 0° and 90° around the perimeter if $\Delta R>0$, and at -45° and +45° if $\Delta R<0$. There is extensive experimental evidence that ear height shows a linear correlation with $\Delta R/R$, but attempts to duplicate this using the finite-element method are highly dependent on both the methodology and yield surface used. It was shown previously that using a coarse mesh and the quadratic Hill yield surface tends to greatly under predict earing. In this study, we have used two different finite-element codes developed at LLNL to examine the predicted earing using both quadratic Hill and alternative non-quadratic yield surfaces. These results are compared to experimental data and conclusions drawn about the most desirable closed-form yield surfaces to duplicate the observed earing phenomena.

21603 (UCRL-JC–120255) **Multilayer thermoelectric films: A strategy for the enhancement of ZT.** Wadgner, A.V.; Foreman,

R.J.; Summers, L.J.; Barbee, T.W. Jr.; Farmer, J.C. Lawrence Livermore National Lab., CA (United States). Mar 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950729–3: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95011535. Source: OSTI; NTIS; GPO Dep.

The relative efficiency of a thermoelectric material is measured in terms of a dimensionless figure of merit, ZT. Although all known thermoelectric materials are believed to have $ZT \leq 1$, recent theoretical results predict that thermoelectric (devices fabricated as two-dimensional quantum wells (2D QWs) could have $ZT \geq 3$. Multilayers with the dimensions of 2D QWs have been synthesized by alternately sputtering $Bi_{0.9}Sb_{0.1}$ and $PbTe_{0.8}Se_{0.2}$ onto a moving substrate from a pair of magnetron sources. These materials have been synthesized to test the thermoelectric quantum-well concept and gain insight into relevant transport mechanisms. This work focuses primarily on the scientific issues involved in producing the materials necessary to examine the possibility of enhancing ZT using quantum confinement. The techniques needed to measure the relevant electrical parameters of thermoelectric thin films are developed in this paper. Ultimately, if a quantum well enhancement of thermoelectrics is experimentally observed, devices based on this technology could be used to greatly expand the role of thermoelectrics in power generation and refrigeration.

21604 (WSRC-MS–94-0416) **Assessment of remaining service life of 1Cr-0.5Mo steam piping.** Daugherty, W.L.; Vormelker, P.R. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950288–1: Microstructure and mechanical properties of aging materials, Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95010972. Source: OSTI; NTIS; GPO Dep.

A Savannah River Site power plant has been in operation for 40 years, producing electricity and process steam for the site. This coal-fired plant employs ICr-0.5Mo steam piping which is exposed to temperatures up to about 500°C in service. With applied loads on the order of 69 MPa (10 ksi), this pipe is at the lower bound of conditions that might lead to service-induced creep damage. Efforts to characterize the creep damage to date and predict the remaining service life are two-fold, employing microstructural characterization (through the use of in-situ metallography) and analytic predictions based on constitutive equations and creep data available in the literature. This effort is part of an overall program to evaluate life extension of this power plant versus new construction. The literature contains many examples of efforts to correlate microstructural changes to the extent of creep damage and remaining service life. A brief review identified examples as far back as the 1950s. The concepts and techniques involved have matured to the point where this means of life prediction can be considered a standard tool in the engineer's arsenal. In this regard, a comparison is made between this approach to life extension and an analytical approach based on basic creep data and constitutive equations. Possible pitfalls of each method are discussed. It is concluded that both approaches can offer valuable insights depending on the circumstances of the situation at hand.

21605 (WSRC-MS–95-0033) **Calibration of a Modified Californium Shuffler.** Sadowski, E.T. (Westinghouse Savannah River Company, AIKEN, SC (United States)); Armstrong, F.; Oldham, R.; Ceo, R.; Williams, N. Westinghouse Savannah River Co., Aiken, SC (United States). 1 Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-950787–2: 36. annual meeting of the Institute for Nuclear Materials Management, Palm Desert, CA (United States), 9-12 Jul 1995). Order Number DE95060152. Source: OSTI; NTIS; INIS; GPO Dep.

A californium shuffler originally designed to assay hollow cylindrical pieces of UA1 has been modified to assay solid cylinders. Calibration standards were characterized via chemical analysis of the molten UA1 taken during casting of the standards. The melt samples yielded much more reliable characterization data than drill samples taken from standards after the standards had solidified. By normalizing one well-characterized calibration curve to several standards at different enrichments, a relatively small number of standards was required to develop an enrichment-dependent calibration. The precision of this shuffler is 0.65%, and the typical random and systematic uncertainties are 0.53% and 0.73%, respectively, for a six minute assay of an ingot containing approximately 700 grams of ^{235}U. This paper will discuss (1) the discrepancies encountered when UA1 standards were characterized via melt samples versus drill samples, (2) a calibration methodology employing a small number of standards, and (3) a comparison of results from a previously unused shuffler with an existing shuffler. A small number of UA1 standards have been characterized using samples from the homogeneous molten state and have yielded enrichment-dependent and enrichment-independent calibration curves on two different shufflers.

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Refer also to citation(s) 20565, 20566, 20584, 20830, 21066, 21115, 21451, 21522, 21574, 21589, 21598, 21644, 21649, 21651, 21709, 22820, 22825, 22826, 22827, 22837, 22839, 22840, 22841

21606 (ANL/ET/CP–83802) **Effect of lead content on Bi-2223 Formation by a two-powder process.** Dorris, S.E.; Pitz, M.A.; Dawley, J.T.; Trapp, D.J. Argonne National Lab., IL (United States). Feb 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950201–14: Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS), Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95009889. Source: OSTI; NTIS; GPO Dep.

Decreasing the total lead content from $Pb_{0.4}$ to $Pb_{0.3}$ significantly stunts Bi-2223 phase development and greatly reduces the critical current density (J_c) of powder-in-tube tapes made by a two-powder process. This effect can be explained on the basis of the solubility limit for lead in 2212. $Pb_{0.4}$ samples exceed the solubility limit for lead in 2212, so lead is rejected to create a lead-rich liquid that enhances the kinetics of 2223 formation during heat treatment. By contrast, a liquid does not form in the $Pb_{0.3}$ sample because its lead content is below the solubility limit. As a result, 2223 formation is much slower and J_c is much lower in the $Pb_{0.3}$ sample.

21607 (ANL/ET/CP–84391) **Transient and steady-state erosion of in-situ reinforced silicon nitride.** Karasek, K.R. (Allied Signal Research and Technology, Des Plaines, IL (United States)); Whalen, P.J.; Rateick, R.G. Jr.; Hamilton, A.C.; Routbort, J.L. Argonne National Lab., IL (United States). Oct 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950584–1: Annual meeting of the Society of Tribologists and Lubrication Engineers, Chicago, IL (United States), 14-18 May 1995). Order Number DE95013436. Source: OSTI; NTIS; GPO Dep.

Relative to most other materials silicon nitride is very erosion resistant. However, the resulting surface flaws degrade strength - a serious concern for component designers. AlliedSignal Ceramic Components GS-44 in-situ reinforced silicon nitride was eroded in a slinger apparatus. Both transient (extremely low level) and steady-state erosion regimes were investigated. Alumina particles with effective average diameters of 140 Jim and 63 μm were used at velocities of 50 m/s, 100 m/s, and 138 m/s. Biaxial tensile strength was measured. Strength decreased by about 15% after a very small erodent dosage and then remained virtually constant with further erosion. In-situ reinforcement produces R-curve behavior in which the fracture toughness increases with crack size. The effect of this is quite dramatic with strength loss being significantly less than expected for a normal silicon nitride with constant fracture toughness.

21608 (ANL/ET/CP–84592) **Electronic/Ionic conductivity and oxygen diffusion coefficient of Sr-Fe-Co-O system.** Ma, B. (Argonne National Lab., IL (United States)); Park, J.H.; Balachandran, U.; Segre, C.U. Argonne National Lab., IL (United States). Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950412–17: Spring meeting of the Materials Research Society (MRS), San

Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95012928. Source: OSTI; NTIS; GPO Dep.

Oxides in the system Sr-Fe-Co-O exhibit both electronic and ionic conductivities. Recently, Sr-Fe-Co-O system attracted great attention because of the potential to be used for oxygen permeable membranes that can operate without the electrodes or external electrical circuitry. Electronic and ionic conductivities at various temperatures have been measured on two compositions in Sr-Fe-Co-O system named SFC-1 and SFC-2. The electronic transference number is much greater than the ionic transference number in SFC-1 sample, while the electronic and ionic transference numbers are very close in SFC-2 sample. At 800°C, the electronic conductivity and ionic conductivity are ≈76 S-cm-1 and =4 S-cm-1, respectively, for SFC-1. While, for SFC-2, the electronic and ionic conductivities are =10 S-cm-1 and ≈7 S-cm-1, respectively. By a local fitting to $\sigma \cdot T = A \exp(-E_a/\kappa T)$, we found that the oxide ion activation energies are 0.92 eV and 0.37 eV respectively for SFC-1 and SFC-2 samples. Oxygen diffusion coefficient of SFC-2 is $\approx \times 10^{-7}$ cm²/sec at 900C.

21609 (ANL/MSD/CP–84416) **Structure and properties of heteroepitaxial $Pb(Zr_{0.35}Ti_{0.65})O_3/SrRuO_3$ multilayer thin films on $SrTiO_3$(100) prepared by MOCVD and RF sputtering.** Foster, C.M. (Argonne National Lab., IL (United States)); Csencsits, R.; Bai, G.R.; Li, Z.; Wills, L.A.; Hiskes, R.; Al-Shareef, H.N.; Dimos, D. Argonne National Lab., IL (United States); Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC04-94AL85000. (CONF-9503144–1: 7. international symposium on integrated ferroelectrics, Colorado Springs, CO (United States), 20-22 Mar 1995). Order Number DE95011420. Source: OSTI; NTIS; GPO Dep.

Epitaxial $SrRuO_3$ thin films were deposited on $SrTiO_3$(100) substrates by RF sputtering for use as bottom electrodes and epitaxial buffer layers. On these conductive substrates, epitaxial $Pb(Zr_{0.35}Ti_{0.65})O_3$ (PZT) thin films were deposited by metalorganic chemical vapor deposition (MOCVD). X-ray diffraction (XRD), transmission electron microscopy (TEM) and optical waveguiding were used to characterize the phase, refractive index, and film thickness of the deposited films. The epitaxial PZT films were c-axis oriented and contained ~19.7% volume fraction of 90° domains. Ferroelectric hysteresis and dielectric measurements of epitaxial PZT ferroelectric capacitor structures formed using sputtered ITO top electrodes showed: a remanent polarization of 51.8μC/cm², a coercive field of 54.9 kV/cm, a dielectric constant of 410, a bipolar resistivity of ~$5.8 \times 10^9 \Omega$-cm at a field of 275 kV/cm, and a breakdown strength of >400 kV/cm. The cyclic fatigue behavior of the films showed a strong dependence on the choice of electrode materials and the fatiguing wave form. These data support the model that the fatigue mechanism in these films arises from the trapping of injected charge carriers and is predominately an electronic phenomenon.

21610 (ANL/MSD/PP–75789) **Comparison of short and longer term loading on the creep behaviour of alumina-silicon carbide whisker composites.** Swan, H. (Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Physics); Arellano-Lopez, A.R. de; Dominguez-Rodriguez, A.; Routbort, J.L.; Swain, M.V. Argonne National Lab., IL (United States). Nov 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012219. Source: OSTI; NTIS; GPO Dep.

The incorporation of SiC whiskers into alumina ceramics has resulted in several improved room temperature properties of the composite such as fracture toughness, strength, erosion resistance and fatigue. The creep resistance has also been generally observed to increase with the addition of whiskers. However, significant scatter in measured secondary creep rates still exist, depending on the material and the test conditions that were utilized. The objective of this investigation was to compare two separate creep tests performed in compression using a SiC_w/Al_2O_3 material obtained from the same process batch. The differences in creep behavior between the tests could thus be ascribed to the difference in creep conditions solely. In one case the creep behavior was studied under short term loading (<3 h) conditions in air, while longer term loading (<100 h) conditions in argon were applied in the other case. The creep results and the microstructure of the samples were compared and related to each other, and to previous results in the literature.

21611 (ANL/MSD/PP–82476) **Origin of 1/f noise peaks of $YBa_2Cu_3O_x$ films in a magnetic field.** Kang, W.N. (Korea Institute of Science and Technology, Seoul (Korea, Democratic People's Republic of). Applied Physics Group); Kim, D.H.; Park, J.H. Argonne National Lab., IL (United States). Feb 1994. 18p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Korean Ministry of Science and Technology (Korea, Republic of). DOE Contract W-31109-ENG-38. Contract No. DMR 91-20000. Order Number DE95013495. Source: OSTI; NTIS; GPO Dep.

The temperature and magnetic field dependence of 1/f noise has been measured in epitaxial $YBa_2Cu_3O_x$ films. In a magnetic field, two noise peaks were observed as temperature decreases; one at higher temperature was found to match the thermal fluctuation of the sample resistance and the other near the foot of the transition was found to be magnetic-field dependent. The location of the latter was shifted toward low temperature and the peak height was decreased as a magnetic field increased. In a zero field only one peak from the resistance fluctuation was observed. We show that the field-dependent noises are due to flux motion interacting with the pinning potential. A classical model is used to explain the field-induced noise peaks. We interpret that the temperature dependences of the flux bundle size and the sample resistance are the reasons for the noise peaks, and a rough estimation of the temperature and field dependence of the flux bundle size is presented. Any possible relationship between the noise peaks and the flux-line-lattice phase transition is also discussed.

21612 (ANL/MSD/PP–84782) **In situ x-ray diffraction study of $CoSi_2$ formation during annealing of a Co/Ti bilayer on Si*(100).** Selinder, T.I. (Argonne National Lab., IL (United States)); Roberts, T.A.; Miller, D.J.; Beno, M.A.; Knapp, G.S.; Gray, K.E.; Ogawa, S.; Fair, J.A.; Fraser, D.B. Argonne National Lab., IL (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant DMR 91-20000. Order Number DE95012213. Source: OSTI; NTIS; GPO Dep.

X-ray diffraction (XRD) was performed in situ during annealing of a Co/Ti/Si(001) multilayer, which produced an epitaxial $CoSi_2$ layer. The results indicate that the Ti layer did. not stay intact during the reaction, and thus could not act like a membrane, moderating Co/Si interdiffusion. A strongly textured metastable phase (M) formed prior to $CoSi_2$ nucleation. This intermediary reaction product was unobservable upon completion of the anneal. We report that nucleation and growth of $CoSi_2$ on Si(100) took place in the presence of M, a new Co-Ti-Si-(O) phase, located at the metal/Si interface. M might play an important role in the perfection of the silicide. Ti and Co metals intermix already below 300°C, and there was evidence that metallic Ti precipitated at the surface, commencing at 550°C.

21613 (CEA-CONF–11769) **Nanometric onion-like hollow spheres in laser synthesized boron nitride ultrafine powder.** Boulanger, L. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies Avancees); Willaime, F.; Cauchetier, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies Avancees. 1994. 2p. (CONF-940766–: 13. international congress on electron microscopy, Paris (France), 17-22 Jul 1994). Order Number DE95630982. Source: OSTI; NTIS (US Sales Only); INIS.

TEM observations of ultra-fine B Cl_3-N H_3 powders elaborated by an innovative method, laser pyrolysis, are presented. The resulting microstructures in the as received state and after thermal treatments show small nanometric scale configurations close to the ones met with carbon, such as an hollowed configuration of onions but at a much smaller scale than with carbon. 3 figs., 3 refs.

21614 (CONF-950129–7) **Optimization of the gelcasting of a silicon nitride formulation.** Omatete, O.O. (Oak Ridge National Lab., TN (United States)); Pollinger, J.P.; O'Young, K. Oak Ridge

National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);National Inst. of Standards and Technology, Gaithersburg, MD (United States). DOE Contract AC05-84OR21400. From 19. annual conference on advanced ceramics, materials and structures; Cocoa Beach, FL (United States); 9-12 Jan 1995. Order Number DE95012898. Source: OSTI; NTIS; GPO Dep.

An optimum gelcasting condition for a silicon nitride formulation was determined using the Taguchi statistical method. An $L_8(4^1 \times 2^4)$ design, in which the effects of one factor at four levels and four factors at two levels were evaluated in only eight experiments, was used. The factors at two levels were: the total monomer concentration, the monomer/crosslinker ratio, the initiator concentration, and the initiator/catalyst ratio; the factor at four levels was the initiator concentration per mass of the slip. The primary criterion used to determine optimum design was the green strength of the dried part, although three other parameters were measured: initial slip viscosity, time for the slip viscosity to reach 300 mPa.s. at 25 C, and time for the slip to gel at 50 C. The optimum gelcasting conditions from the designed experiments predicted 80% increase in green strength (4.3 MPa versus 2.4 MPa, the initial value). The confirmation runs showed only a 60% increase (3.8 MPa).

21615 (CONF-950129–8) **Gas pressure sintering of silicon nitride to optimize fracture toughness.** Tiegs, T.N.; Nunn, S.D.; Beavers, T.M.; Menchhofer, P.A.; Barker, D.L.; Coffey, D.W. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 19. annual conference on advanced ceramics, materials and structures; Cocoa Beach, FL (United States); 9-12 Jan 1995. Order Number DE95012899. Source: OSTI; NTIS; GPO Dep.

Gas-pressure sintering (GPS) can be used to densify silicon nitride containing a wide variety of sintering additives. Parameters affecting the sintering behavior include densification temperature, densification time, grain growth temperature, grain growth time and heating rates. The Si_3N_4-6% Y_2O_3-2% $A1_2O_3$ samples sintered to high densities at all conditions used in the present study, whereas the Si_3N_4-$Sr_2La_4Yb_4(SiO_4)_6O_2$ samples required the highest temperatures and longest times to achieve densities $\geq$98 % T. D. The main effect on the fracture toughness for Si_3N_4-6% Y_2O_3-2% $A1_2O_3$ samples was the use of a lower densification temperature, which was 1900C in the present study. For the Si_3N_4-$Sr_2La_4Yb_4SiO4_4)_6O_2$ composition, fracture toughness was sensitive to and improved by a slower heating rate (10c/min), a lower densification temperature (1900'), a higher grain growth temperature (2000C), and a longer grain growth time (2 h).

21616 (CONF-950637–1) **Defect formation and carrier doping in epitaxial films of the "parent" compound $SrCuO_2$: Synthesis of two superconductors descendants.** Feenstra, R. (Oak Ridge National Lab., TN (United States)); Norton, D.P.; Budai, J.D.; Jones, E.C.; Christen, D.K.; Kawai, T. Oak Ridge National Lab., TN (United States). Apr 1995. 3p. Sponsored by USDOE, Washington, DC (United States);Japan Society for the Promotion of Science, Tokyo (Japan). DOE Contract AC05-84OR21400. From International workshop on superconductivity: controlled processing of high temperature superconductors - fundamentals and applications; Maui, HI (United States); 18-21 Jun 1995. Order Number DE95012871. Source: OSTI; NTIS; INIS; GPO Dep.

The infinite layer or parent compounds $ACuO_2$ (A: Ca-Sr-Ba) constitute the simplest copper oxygen perovskites that contain the CuO_2 sheets essential for superconductivity. The stabilization of these basic "building blocks" as epitaxial films, therefore, provides alluring opportunities towards the search for new superconducting compounds and elucidation of the underlying mechanisms. In this work, general trends of the defect formation and carrier doping for epitaxial films of the intermediate endmember $SrCuO_2$ are reviewed. First results are presented from successful attempts to induce hole-doped superconductivity via the processing-controlled incorporation of charge reservoir layers.

21617 (CONF-950637–2) **Effect of the colony microstructure on transport critical current of high-J_c Tl-1223 thick films.** Goyal, A. (Argonne National Lab., IL (United States)); Specht, E.D.; Kroeger, D.M.; Christen, D.K.; Tkaczyk, J.E.; DeLuca, J.A.; Sutliff, J.A. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International workshop on superconductivity: controlled processing of high temperature superconductors - fundamentals and applications; Maui, HI (United States); 18-21 Jun 1995. Order Number DE95013049. Source: OSTI; NTIS; GPO Dep.

High J_c, polycrystalline, $TlBa_2Ca_2Cu_3O_{8+x}$ thick films on poly-YSZ substrates were examined by x-ray microdiffraction, electron microscopy, and electron backscatter diffraction. The superconducting phase was formed by vapor phase thallination. X-ray phi scans were used to study the local and macroscopic in-plane texture. Electron backscatter kikuchi diffraction was used to discern the grains structure within the colonies. Figure shows results of a limiting path calculation of J_c vs colony mosaic.

21618 (CONF-9508127–1) **R-curve behavior of whisker-reinforced ceramic composites.** Hsueh, Chun-Hway; Becher, P.F. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international conference on high temperature ceramic matrix composites; Santa Barbara, CA (United States); 21-25 Aug 1995. Order Number DE95012873. Source: OSTI; NTIS; GPO Dep.

Ceramics have attracted great interest for advanced heat engines and industrial applications as a result of their stiffness, light weight, corrosion resistance, and superior performance at high temperatures. However, their utilization in engineering applications is severely limited by their brittleness. One approach toward substantially reducing this brittleness is by incorporating strong whiskers into the ceramic matrix. Studies of whisker-reinforced ceramic composites have shown both rising fracture resistance with crack extension (i.e. R-curve behavior) and a three- to four-fold increase in steady-state toughness. The primary toughening mechanism is bridging of the crack surface by whiskers. This paper discusses the bridging mechanism in detail and presents R-curves for SiC whisker-reinforced Al_2O_3 composites.

21619 (ETDE/JP-mf–95787249) **Researches on tungsten carbide.** National Inst. for Researches in Inorganic Materials, Tsukuba, Ibaraki (Japan). 24 Nov 1994. 80p. (In Japanese). Order Number DE95787249. Source: OSTI; NTIS; Available from National Institute for Research in Inorganic Materials, 1-1, Namiki, Tsukuba, Ibaraki, Japan.

This paper summarizes results of the researches on tungsten carbide (WC), carried out in the 5-year period starting 1989 by the Science and Technology Agency's National Institute for Researches in Inorganic Materials. The high-frequency heating, floating zone technique, generally suited for growth of large-size, single crystals of high melting materials, is inapplicable to the hexagonal WC system, which is decomposed. This problem has been solved by adding boron to the system, to allow it to exist with the W-C-B melt at an equilibrium. The computer-aided control techniques have enabled automatic growth of the single crystals of carbides and borides. The de Haas-Van Alphen effect of the single WC crystals has been observed, to establish the Fermi surface model. The single crystals of transition metal carbides, such as WC, have been coated with the monolayer of graphite at high repeatability, to create the surface layer materials. An attempt has been done to produce the halite type structure by substituting Ti as the atom in the outermost layer of TiC by W. The new method, based on the low-speed deuterium ion scattering, has been developed to analyze the surface bonding conditions, clarifying the conditions of alkalis adsorbed on and bonded to metallic surfaces, and their surface reactivities. 159 refs., 111 figs., 8 tabs.

21620 (FEI–2358) **Metal-insulator phase transitions in the systems with dipole-dipole interaction.** Plaksin, O.A.; Stepanov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 17p. (In Russian). Order Number DE95633129. Source: OSTI; NTIS (US Sales Only); INIS.

An approach to metal-insulator phase transitions (MIPT) concerning with dipole-dipole interaction in systems has been introduced. Along with dipole states owing to local structural distortions there localized electrons states are considered in Hamiltonian.

Concentration of delocalized electrons is an objective parameter of the model. Phase diagrams have been determined. Jump-wise increase of the concentration of delocalized electrons on heating has been obtained (MIPT). MIPT of the first order can take place in both two-phase regions or single-phase regions of the phase diagram. Parameters of MIPT in VO_2, V_2O_3, Ti_2O_3, Fe_3O_4, $NbCl_4$ have been estimated. 5 refs.; 4 figs.; 1 tab.

21621 (INIS-mf–15113) **Molecular beam epitaxy of high-Tc superconductors. Final report.** Dietsche, W.; Eissler, D.; Fischer, A.; Kershaw, Y.; Ploog, K.; Wang, H.S. Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany). 1993. 98p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 13N5805. Order Number DE95785525. Source: OSTI; NTIS (US Sales Only); INIS.

The document discusses the preparation of $DyBa_2Cu_3O_7$-δ-films by MBE in detail. The structural properties of the high-temperature superconducting films are examined by means of the atomic scanning tunneling and the atomic force microscopy, as well as by means of X-ray techniques, and are brought in relation with the superconducting properties. The surface of the $SrTiO_3$-substrates is studied in detail by atomic force microscopy. (orig.)

21622 (LA-SUB–95-63) **A new US manufacturing capability of glass preforms for fiber optics in defense programs. Final project report.** Nath, D.K. (Polymicro Technologies, Inc., Phoenix, AZ (United States)). Los Alamos National Lab., NM (United States); Polymicro Technologies, Inc., Phoenix, AZ (United States). Jun 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012078. Source: OSTI; NTIS; GPO Dep.

The present project is a part of the program to develop "A New US Manufacturing Capability of Fiber Optics in Defense Programs." The scope of the program extends beyond the limit of defense needs, impacting profoundly on important national issues such as, health industry vis-a-vis medical and insurance infrastructure as well as a great segment of commercial-industrial complex. At present, the glass preform – critical raw material to produce the optical fiber, is 100% imported from Germany and Japan. Objectively, to create a domestic source, a cooperative project participated by Los Alamos and Polymicro began in the summer of 1991 to develop the cladding part of the glass preform. The goal was achieved by developing 0·2NA preform, that was fabricated by Modified Chemical Vapor Deposition (MCVD) of born and fluorine doped silica glass as cladding layer on a silica substrate tube and collapsing the tube on a solid silica rod as the core. The preform was finally drawn into 200 micron core optical fiber and delivered to Los Alamos National Laboratory.

21623 (LA-UR–94-1148, pp. 552-555) **Impurities: A smoking gun for the physical origin of high temperature superconductivity.** Pines, D. (Physics Department and Science and Technology Center for Superconductivity, Urbana, IL (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DMR 91-20000; Grant PHY 89-04035. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Philippe Monthoux and the author have recently carried out detailed strong coupling (Eliashberg) calculations for $YBa_2Cu_3O_7$ of the influence of impurities on the normal state quasiparticle self-energy and resistivity, and the superconducting transition temperature, T_c. They find, in agreement with experiment, that although both Ni and Zn impurities primarily substitute for planar Cu(2) atoms, their influence on T_c is markedly different. That difference arises from the experimental fact that Zn, when substituted for Cu(2), alters the local magnetic order, and hence the local spin fluctuation spectrum, while Ni does not. This difference is the equivalent of the isotope effect for conventional superconductors: it is a smoking gun for the physical origin of high temperature superconductivity and provides strong evidence for the spin-fluctuation mechanism, and the $d_{x^2-y^2}$ pairing state to which it gives rise.

21624 (LA-UR–94-1148, pp. 601-604) **Strongly anisotropic s-wave vs. d-wave gap in cuprate superconductors: Evidence and theory.** Brandow, B. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Most of the evidence supporting a d-wave gap form can be explained equally well by a highly anisotropic s-wave gap form. The latter is supported by further experimental evidence and by a dynamical argument, as well as by nearly ab initio calculations based on a systematic theory. As is well known, the d-wave gap scenario for cuprate superconductors has strong support from several lines of evidence: (1) Evidence for strong gap anisotropy, e.g. the Stanford photoemission data. (2) Evidence for gap nodes, e.g. the UBC studies of penetration depth $\lambda_L(T)$ at low T ($\ll T_c$). (3) A pairing interaction based on the strong quasiparticle repulsion at $q=(\pi,\pi)$, the latter being clearly established from inelastic neutron scattering and NMR data. Furthermore, (4) the phenomenological theory also provides a source for the strong (and linear) resistivity. The d-wave gap scenariao and theory are therfore very plausible.

21625 (LBL–35424) **Characterization of superconductors with artificial pinning microstructures.** Dietderich, D.R.; Scanlan, R.M. Lawrence Berkeley Lab., CA (United States). Oct 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-941013–48: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012391. Source: OSTI; NTIS; INIS; GPO Dep.

Extension of the APC approach to Nb_3Sn requires that a second phase be introduced into the Nb_3S reaction layer with the intent of increasing the volume pinning strength. This can be achieved by either the refinement of the Nb_3S grains due to the presence of a second phase or by the second phase itself pinning flux. If a bronze-type process is to be used a different addition than Zr is required since internal oxidation of Nb is not possible. The criteria for elements to be candidates for the APC approach are discussed. The results for one of the candidates (Ag) show that it is not incorporated into the Nb_3S, however, its addition did increase the growth rate.

21626 (LBL–36924) **Processing and characterization of SIC platelet/SIC composites.** Cao, J.J.; MoberlyChan, W.J.; De Jonghe, L.C.; Dalgleish, B.; Niu, M.Y. Lawrence Berkeley Lab., CA (United States). Mar 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940416–34: 96. annual meeting of the American Ceramic Society (ACS), Indianapolis, IN (United States), 25-28 Apr 1994). Order Number DE95012381. Source: OSTI; NTIS; GPO Dep.

Hot pressed β-SiC and SiC matrix composites containing encapsulated α-SiC platelets were prepared and investigated. The Microstructures were characterized using electron microscopy, Auger electron spectroscopy, and x-ray diffraction. Prior to hot pressing, the platelets were either encapsulated with hydrated aluminum sulfate or yttrium hydroxycarbonate (later calcined to form alumina or yttria) from aqueous solutions, or oxidized to form a silica layer. The effect of these interfacial layers on toughness was described.

21627 (ORNL/SUB–85-55901/05) **Finite-volume model for chemical vapor infiltration incorporating radiant heat transfer. Interim report.** Smith, A.W. (Georgia Institute of Technology, Atlanta, GA (United States). School of Materials Science and Engineering); Starr, T.L. Oak Ridge National Lab., TN (United States); Georgia Inst. of Tech., Atlanta, GA (United States). School of Materials Science and Engineering. May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012164. Source: OSTI; NTIS; GPO Dep.

Most finite-volume thermal models account for the diffusion and convection of heat and may include volume heating. However, for certain simulation geometries, a large percentage of heat flux is due to thermal radiation. In this paper a finite-volume computational procedure for the simulation of heat transfer by conduction,

convection and radiation in three dimensional complex enclosures is developed. The radiant heat transfer is included as a source term in each volume element which is derived by Monte Carlo ray tracing from all possible radiating and absorbing faces. The importance of radiative heat transfer is illustrated in the modeling of chemical vapor infiltration (CVI) of tubes. The temperature profile through the tube preform matches experimental measurements only when radiation is included. An alternative, empirical approach using an "effective" thermal conductivity for the gas space can match the initial temperature profile but does not match temperature changes that occur during preform densification.

21628 (PNL-SA-25315) **Influence of processing variables on the structure and properties of ZnO films.** Exarhos, G.J. (Pacific Northwest Lab., Richland, WA (United States)); Sharma, S.K. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950454-2: 22. international AVS conference on metallurgical coatings and thin films, San Diego, CA (United States), 24-28 Apr 1995). Order Number DE95011494. Source: OSTI; NTIS; GPO Dep.

Zinc oxide films of high optical quality have been deposited onto both silica and silicon substrates using reactive sputtering, pulsed laser deposition, and an aqueous solution based technique. Films have been characterized with respect to crystalline phase and phase stability, surface morphology, and optical response by means of X-ray diffraction, Raman Spectroscopy, Atomic Force Microscopy, optical transmission and ellipsometry measurements. All films studied were of the wurtzite phase, fine-grained, and exhibited varying degrees of c-axis orientation with respect to the substrate normal depending upon deposition conditions. Films showed some degree of residual tensile stress which was inferred from the E_2 Raman line shift relative to the single crystal frequency. The wurtzite phase was found to be stable to temperatures near 800°C, but at higher temperatures, reaction with silica led to evolution of Zn_2SiO_4 at the interface. Variations in Raman line intensities upon post deposition annealing has been correlated with oxidation of excess zinc in the lattice.

21629 (RISO-R-796(EN)) **Perovskite-type metal oxides. Electrical conductivity and structure.** Ranloev, J. Risoe National Lab., Roskilde (Denmark). Materials Dept. Jan 1995. 133p. Order Number DE95779167. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

Structural behavior and electrical conductivity of these materials varies strongly with the chemical composition. This work describes the results of a systematic investigation of the interrelationship of crystal structure and ionic conductivity for selected members of the perovskite-type metal oxides. These include acceptor doped $SrCeO_3$ and $Ln[Al_{0.95}Mg_{0.05}]O_{3-y}$ (Ln = La, Nd, Sm, Gd, Tb, Er and Y). (au) (19 tabs., 62 ills., 136 refs.)

21630 (SAND-94-3266) **Dynamic properties of ceramic materials.** Grady, D.E. (Sandia National Labs., Albuquerque, NM (United States). Experimental Impact Physics Dept.). Sandia National Labs., Albuquerque, NM (United States). Feb 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010333. Source: OSTI; NTIS; INIS; GPO Dep.

The present study offers new data and analysis on the transient shock strength and equation-of-state properties of ceramics. Various dynamic data on nine high strength ceramics are provided with wave profile measurements, through velocity interferometry techniques, the principal observable. Compressive failure in the shock wave front, with emphasis on brittle versus ductile mechanisms of deformation, is examined in some detail. Extensive spall strength data are provided and related to the theoretical spall strength, and to energy-based theories of the spall process. Failure waves, as a mechanism of deformation in the transient shock process, are examined. Strength and equation-of-state analysis of shock data on silicon carbide, boron carbide, tungsten carbide, silicon dioxide and aluminum nitride is presented with particular emphasis on phase transition properties for the latter two. Wave profile measurements on selected ceramics are investigated for evidence of rate sensitive elastic precursor decay in the shock front failure process.

21631 (SAND-95-0500) **Analysis of the frequency response of a TeO_2 slow shear wave acousto-optic cell exposed to radiation.** Erteza, I.A. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 39p. Sponsored by USDOE, Washington, DC (United States);Defense Nuclear Agency, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012520. Source: OSTI; NTIS; GPO Dep.

Radiation testing of photonic components is not new, however component level testing to date has not completely addressed quantities which are important to system behavior. One characteristic that is of particular importance for optical processing systems is the frequency response. In this report, we present the analysis of data from an experiment designed to provide a preliminary understanding of the effects of radiation on the frequency response of acousto-optic devices. The goal of the analysis is to describe possible physical mechanisms responsible for the radiation effects and to discuss the effects on signal processing functionality. The experiment discussed in this report was designed by Sandia National Laboratories and performed by Sandia and Phillips Laboratory personnel at White Sands Missile Range (WSMR). In the experiment, a TeO_2 slow shear wave acousto-optic cell was exposed to radiation from the WSMR linear accelerator. The TeO_2 cell was placed in an experimental configuration which allowed swept frequency diffracted power measurements to be taken during radiation exposure and recovery. A series of exposures was performed. Each exposure consisted of between 1 to 800, 1μsec radiation pulses (yielding exposures of 2.25 kRad(Si) to 913 kRad(Si)), followed by recovery time. At low total and cumulative doses, the bandshape of the frequency response (i.e. diffracted power vs. frequency) remained almost identical during and after radiation. At the higher exposures, however, the amplitude and width of the frequency response changed as the radiation continued, but returned to the original shape slowly after the radiation stopped and recovery proceeded. It is interesting to note that the location of the Bragg degeneracy does not change significantly with radiation. In this report, we discuss these effects from the perspective of anisotropic Bragg diffraction and momentum mismatch, and we discuss the effect on the signal processing functionality.

21632 (SAND-95-0595) **Electron beam joining of structural ceramics.** Turman, B.N.; Glass, S.J.; Halbleib, J.A.; Helmich, D.R.; Loehman, R.E. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012521. Source: OSTI; NTIS; GPO Dep.

Feasibility of ceramic joining using a high energy (10 MeV) electron beam. The experiments used refractory metals as bonding materials in buried interfaces between Si_3N_4 pieces. Because the heat capacity of the metal bonding layer is much lower than the ceramic, the metal reaches much higher temperatures than the adjoining ceramic. Using the right combination of beam parameters allows the metal to be melted without causing the adjoining ceramics to melt or decompose. Beam energy deposition and thermal simulations were performed to guide the experiments. Joints were shear tested and interfaces between the metal and the ceramic were examined to identify the bonding mechanism. Specimens joined by electron beams were compared to specimens produced by hot-pressing. Similar reactions occurred using both processes. Reactions between the metal and ceramic produced silicides that bond the metal to the ceramic. The molybdenum silicide reaction products appeared to be more brittle than the platinum silicides. Si_3N_4 was also joined to Si_3 N_4 directly. The bonding appears to have been produced by the flow of intergranular glass into the interface. Shear strength was similar to the metal bonded specimens. Bend specimens Of Si_3N_4 were exposed to electron beams with similar parameters to those used in joining experiments to determine how beam exposure degrades the strength. Damage was macroscopic in nature with craters being tonned by material ablation, and cracking occurring due to excessive thermal stresses. Si was also observed on the surface indicating the Si_3N_4 was decomposing. Bend strength after exposure was 62% of the asreceived strength. No obvious microstructural differences were observed in the material close to the damaged region compared to material in regions far away from the damage.

21633 (SAND–95-0934C) **Synthesis of silicon nitride powders in pulsed RF plasmas.** Buss, R.J. (Sandia National Labs., Albuquerque, NM (United States)); Ho, P.; Babu, S.V. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505204–1: 9, annual conference on fossil energy materials, Oak Ridge, TN (United States), 16-18 May 1995). Order Number DE95011607. Source: OSTI; NTIS; GPO Dep.

Nanometer size silicon nitride particles are synthesized using a pulsed radio frequency plasma technique. The plasma is modulated with a square-wave on/off cycle of varying period to control size and morphology and to deduce the growth kinetics. In situ laser light scattering and ex situ particle analysis are used to study the nucleation and growth. For SiH_4/Ar plasmas which nucleate silicon particles, an initial extremely rapid growth phase is followed by a slower growth rate, approaching the rate of thin film deposition on adjacent flat surfaces. In SiH_4/NH_3 plasmas, silicon nitride particle size can be tightly controlled by adjusting the plasma-on time. The size dispersion of the particles is large and is consistent with a process of continual nucleation during the plasma-on period. The observed polydispersity differs dramatically from that reported from other laboratories.

21634 (SAND–95-0936C) **High rate dry etching of GaN, AlN and InN in ECR $Cl_2/CH_4/H_2$/Ar plasmas.** Vartuli, C.B. (Univ. of Florida, Gainesville, FL (United States)); Pearton, S.J.; Abernathy, C.R.; Shul, R.J.; Kilcoyne, S.P.; Crawford, M.H.; Howard, A.J.; Parmeter, J.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950412–12: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95011872. Source: OSTI; NTIS; GPO Dep.

Etch rates for binary nitrides in ECR $Cl_2/CH_4/H_2$/Ar are reported as a function of temperature, rf-bias, microwave power, pressure and relative gas proportions. GaN etch rates remain relatively constant from 30 to 125°C and then increase to a maximum of 2340 Å-min^{-1} at 170°C. The AlN etch rate decreases throughout the temperature range studied with a maximum of 960 Å-min^{-1} at 30°C. When CH_4 is removed from the plasma chemistry, the GaN and InN etch rates are slightly lower, with less dramatic changes with temperature. The surface composition of the III-V nitrides remains unchanged over the temperatures studied. The GaN and InN rates increase significantly with rf power, and the fastest rates for all three binaries are obtained at 2 mTorr. Surface morphology is smooth for GaN over a wide range of conditions, whereas InN surfaces are more sensitive to plasma parameters.

21635 (SAND–95-8518C) **Planar laser-induced fluorescence imaging of Si and SIO during pulsed laser ablation of Si.** Paul, P.H. (Sandia National Labs., Livermore, CA (United States). Combustion Research Facility); Capewell, D.L.; Goodwin, D.G. Sandia National Labs., Livermore, CA (United States). 4 Feb 1995. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950226–45: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95010698. Source: OSTI; NTIS; GPO Dep.

Pulsed laser deposition (PLD) in the presence of oxygen is an attractive method to deposit oxide films. However, the factors governing oxide film growth are still very poorly understood, due largely to the complexity of this process. Some of the important features of PLD with a background gas are the absorption of laser energy by the target and by electrons in the plasma above the target, the supersonic expansion of the hot plasma particles into the background gas, chemistry within the plume or between plume species and background molecules, and finally the impact of plume species, shock-heated background gas molecules, and reactive intermediates created by gas-phase chemistry with the substrate. Time-resolved imaging of the plume can shed light on some of these complex processes. Ideally, one would like to acquire temporally- and spatially-resolved images of individual chemical species in their electronic ground states, since these provide the greatest insight into the chemistry and are most directly comparable to numerical simulations. Here, planar laser induced fluorescence has been used to acquire time sequence images of ground-state, neutral Si and SiO during laser ablation of an Si target in vacuum and in the presence of background gas at a fluence of 3–4 J/cm^2. The SiO images, taken in air and in oxygen, strongly suggest that the observed SiO is created through reaction of silicon with oxygen at the contact front as the plume expands.

21636 (UCRL-JC–119217) **Superplastic ceramics and intermetallics and their potential applications.** Wadsworth, J.; Nieh, T.G. Lawrence Livermore National Lab., CA (United States). Nov 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941270–1: Superplasticity - 60 years after Pearson conference, Manchester (United Kingdom), 7-8 Dec 1994). Order Number DE95013454. Source: OSTI; NTIS; INIS; GPO Dep.

Recent advances in the basic understanding of superplasticity and superplastic forming of ceramics and intermetallics are reviewed. Fine-grained superplastic ceramics, including yttria-stabilized tetragonal zirconia polycrystal, Y- or MgO-doped Al_2O_3 Hydroxyapatite, β-spodumene glass ceramics, Al_20_3-YTZP two-phase composites, SiC-Si_3N_4 and Fe-Fe_3C composites, are discussed. Superplasticity in the nickel-base (e.g., Ni_3Al and Ni_3Si) and titanium-base intermetallics (TiAl and $T1_3Al$), is described. Deformation mechanisms as well as microstructural requirements and effects such as grain size, grain growth, and grain-boundary phases, on the superplastic deformation behavior am addressed. Factors that control the superplastic tensile elongation of ceramics are discussed. Superplastic forming, and particularly biaxial gas-pressure forming, of several ceramics and intermetallics are presented with comments on the likelihood of commercial application.

3606 Other Materials

Refer also to citation(s) 20548, 20549, 20550, 20551, 20552, 20553, 20554, 20576, 20584, 20746, 20763, 20781, 20832, 20835, 20839, 20871, 21115, 21116, 21328, 21446, 21457, 21589, 21627, 21712, 21714, 21775, 21790, 21832, 21837, 21840, 21841, 21842, 22109, 22114, 22124, 22133, 22783

21637 (ANL/CHM/CP–85037) **In situ surface roughness measurement during PECVD diamond film growth.** Zuiker, C.D.; Gruen, D.M.; Krauss, A.R. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505192–2: 4. international symposium on diamond materials, Reno, NV (United States), 21-26 May 1995). Order Number DE95013411. Source: OSTI; NTIS; GPO Dep.

To investigate the development of surface morphology and bulk optical attenuation in diamond films, we have followed diamond film growth on silicon by in-situ laser reflection interferometry in a microwave plasma chemical vapor deposition system. A model for the interpretation of the reflectivity data in terms of film thickness, rms surface roughness and bulk losses due to scattering and absorption is presented. Results are compared with ex situ measurements of these quantities and found to be in good agreement.

21638 (ANL/CHM/CP–85655) **XUV postionization of fragments of photodissociated C_{60}.** Lykke, K.R. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950518–9: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013534. Source: OSTI; NTIS; GPO Dep.

We report experimental evidence for the loss of neutral C, C_2, C_3, and C_4 from photoexcited C_{60} and C_{70}. These species are detected by postionization with XUV radiation formed by four-wave mixing in Kr vapor. The fragments have been detected in the nascent distribution (i.e., before total disintegration of the fullerene-size molecular entities). A resonant autoionization transition in C atom has yielded an upper limit to the translational energy release

for dissociation into C atoms. The detection of these products gives new insight into the fragmentation mechanism of fullerenes.

21639 (ANL/CHM/CP–86016) **Physical and tribological properties of diamond films grown in argon-carbon plasmas.** Zuiker, C.; Krauss, A.R.; Gruen, D.M.; Pan, X.; Li, J.C.; Csencsits, R.; Erdemir, A.; Bindal, C.; Fenske, G. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950454–5: 22. international AVS conference on metallurgical coatings and thin films, San Diego, CA (United States), 24-28 Apr 1995). Order Number DE95012918. Source: OSTI; NTIS; GPO Dep.

Nanocrystalline diamond films have been deposited using a microwave plasma consisting of argon, 2–10% hydrogen and a carbon precursor such as C_{60} or CH_4. It was found that it is possible to grow the diamond phase with both carbon precursors, although the hydrogen concentration in the plasma was 1–2 orders of magnitude lower than normally required in the absence of the argon. Auger electron spectroscopy, x-ray diffraction measurements and transmission electron microscopy indicate the films are predominantly composed of diamond. Surface roughness, as determined by atomic force microscopy and scanning electron microscopy indicate the nanocrystalline films grown in low hydrogen content plasmas grow exceptionally smooth (30–50 nm) to thicknesses of 10 μm. The smooth nanocrystalline films result in low friction coefficients (μ=0.04–0.06) and low average wear rates as determined by pin-on-disk measurements.

21640 (ANL/ET/CP–85882) **Characterization of transfer layers on steel surfaces sliding against diamondlike carbon in dry nitrogen.** Erdemir, A. (Argonne National Lab., IL (United States)); Bindal, C.; Pagan, J.; Wilbur, P. Argonne National Lab., IL (United States). Mar 1995. 21p. Sponsored by USDOE, Washington, DC (United States);Camlica Foundation of Istanbul (Turkey);Sakarya Univ. (Turkey). DOE Contract W-31-109-ENG-38. (CONF-950454–3: 22. international AVS conference on metallurgical coatings and thin films, San Diego, CA (United States), 24-28 Apr 1995). Order Number DE95012927. Source: OSTI; NTIS; GPO Dep.

Transfer layers on sliding steel surfaces play important roles in tribological performance of diamondlike carbon films. This study investigated the nature of transfer layers formed on M50 balls during sliding against diamondlike carbon (DLC) films (1.5 μm thick) prepared by ion-beam deposition. Long-duration sliding tests were performed with steel balls sliding against the DLC coatings in dry nitrogen at room temperature and zero humidity. Test results indicated that the friction coefficients of test pairs were initially 0.12 but decreased steadily with sliding distance to 0.02-0.03 and remained constant throughout the tests, which lasted for more than 250,000 sliding cycles (30 km). This low-friction regime appeared to coincide with the formation of a carbon-rich transfer layer on the sliding surfaces of M50 balls. Micro-laser-Raman spectroscopy and electron microscopy were used to elucidate the structure and chemistry of these transfer layers and to reveal their possible role in the wear and friction behavior of DLC-coated surfaces.

21641 (ANL/MSD/CP–83373) **Epitaxial $Pb(Zr_{0.40}Ti_{0.60})O_3$/$SrRuO_3$ and $PbTiO_3$/$SrRuO_3$ multilayer thin films prepared by MOCVD and rf sputtering.** Foster, C.M. (and others); Csencsits, R.; Baldo, P.M. Argonne National Lab., IL (United States). Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC04-94AL85000. (SAND–95-1145C; CONF-941144–148: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95007146. Source: OSTI; NTIS; GPO Dep.

Epitaxial $SrRuO_3$ thin films were deposited by RF sputtering on $SrTiO_3$ or MgO substrates for use as underlying electrodes. On these conductive substrates, epitaxial $Pb(Zr_{0.35}Ti_{0.65})O_3$ (PZT) and $PbTiO_3$ (PT) thin films were, deposited by metalorganic chemical vapor deposition (MOCVD). X-ray diffraction (XRD), RBS channeling (RBS), transmission electron microscopy (TEM) and optical waveguiding were used to characterize phase, microstructure, defect structure, refractive index, and film thickness of the deposited films. The PZT and PT films were epitaxial and c-axis oriented. 90° domains, interfacial misfit dislocations and dislocations and threading dislocations were the primary structural defects, and the films showed a 70% RBS channeling reduction. Hysteresis and dielectric measurements of epitaxial PZT ferroelectric capacitor structures formed using evaporated Ag or ITO glass top electrode showed: a remanent polarization of 46.2 mC/cm^2, a coercive field of 54.9 KV/cm, a dielectric constant of 410, a bipolar resistivity of $\sim 5.8 \times 10^9$ Ω-cm at a field of 275 KV/cm, and a breakdown strength of >400 KV/cm.

21642 (ANL/MSD/PP–77687) **Surface brillouin scattering from graphite.** Grimsditch, M. Argonne National Lab., IL (United States). Oct 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012209. Source: OSTI; NTIS; GPO Dep.

This report discusses the conflicting results of two previous Brillouin scattering determinations of the C_{44} elastic modulus of graphite.

21643 (CONF-950129–9) **Oxidation-resistant interfacial coatings for continuous fiber ceramic composites.** Shanmugham, S. (Tennessee Univ., Knoxville, TN (United States)); Liaw, P.K.; Stinton, D.P.; Bleier, A.; Besmann, T.M.; Lara-Curzio, E.; Rebillat, F. Oak Ridge National Lab., TN (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 19. annual conference on advanced ceramics, materials and structures; Cocoa Beach, FL (United States); 9-12 Jan 1995. Order Number DE95013354. Source: OSTI; NTIS; GPO Dep.

Developing an oxidation-resistant interfacial coating for continuous fiber ceramic composites (CFCCs) continues to be a major challenge. CFCCs' mechanical behavior are influenced by the interfacial bonding characteristics between the fiber and the matrix. Finite element modeling studies suggest that a low-modulus interfacial coating material will be effective in reducing the residual thermal stresses that are generated upon cooling from processing temperatures. Nicalon/SiC composites with carbon, alumina and mullite interfacial coatings were fabricated with the SiC matrix deposited using a forced-flow chemical vapor infiltration process. Composites with mullite interfacial coatings exhibited considerable fiber pull-out even after oxidation and have potential as a composite system.

21644 (CONF-950412–14) **Modeling and simulation of pulsed laser annealing and ablation of solid materials.** Liu, C.L.; Wood, R.F. Oak Ridge National Lab., TN (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995. Order Number DE95012888. Source: OSTI; NTIS; GPO Dep.

A previously developed one-dimensional (ID) computational model for heat flow and nonequilibrium phase change phenomena induced by pulsed-laser irradiation has been extended to two-dimensions. The 2D modeling focuses attention on the heat flow from localized sources embedded in an otherwise planar matrix. For example, nucleation events occurring in undercooled liquids such as molten Si formed by pulsed-laser melting of amorphous Si (a-Si) and inhomogeneous absorption due to randomly occurring defects in targets used for pulsed-laser ablation can be treated. Concepts introduced in the ID modeling, such as the state diagram and the state array are extended to 2D and refined. As an example of the calculations that are now possible, the laser-induced formation and propagation of buried liquid layers are followed in two dimensions for the case of a-Si on a crystalline silicon substrate. It is demonstrated how solid phase growth from individual nucleation sites gives rise to a nearly planar liquid layer propagating through the a-Si. Another example briefly addresses questions related to the early stages of the laser ablation of insulators such as MgO, where it is believed that the absorption of the laser radiation occurs at localized but extended regions of high concentrations of defects. The 2-D program has been rewritten for massively parallel machines such as the Intel Paragons in ORNL's Center for Computational Sciences by one of us (CLL), thus allowing larger and

more accurate calculations for complex systems to be carried out in reasonable times.

21645 (CONF-9505219–1) **Formation of artificially-layered high-temperature superconductors using pulsed-laser deposition.** Norton, D.P.; Chakoumakos, B.C.; Budai, J.D. Oak Ridge National Lab., TN (United States). Mar 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. international conference on laser ablation (COLA '95); Strasbourg (France); 22-26 May 1995. Order Number DE95012884. Source: OSTI; NTIS; GPO Dep.

Pulsed-laser deposition has been used to synthesize artificially-layered high-temperature superconductors. Novel thin-film $SrCuO_2$/$BaCuO_2$ superlattices have been synthesized which superconduct at temperatures as high as 70 K. These results demonstrate that pulsed-laser deposition and epitaxial stabilization can be effectively used to engineer artificially-layered thin-film materials.

21646 (CONF-950820–1) **Highly doped p-ZnTe films and quantum well structures grown by nonequilibrium pulsed laser ablation.** Lowndes, D.H. (Oak Ridge National lab., TN (United States). Solid State Div.); Rouleau, C.M.; Budai, J.D.; Geohegan, D.B.; McCamy, J.W. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 11. international conference on the electronic properties of two dimensional systems; Nottingham (United Kingdom); 7-11 Aug 1995. Order Number DE95012885. Source: OSTI; NTIS; GPO Dep.

Highly p-doped ZnTe films have been grown on semi-insulating GaAs (001) and unintentionally doped (p-type) GaSb (001) substrates by pulsed KrF (248 nm) excimer laser ablation of a ZnTe target through an N_2 ambient, without the use of any assisting (DC or AC) plasma source. Free hole concentrations in the mid-10^{19} cm^{-3} to $> 10^{20}$ cm^{-3} range have been obtained. This appears to be the first time that any wide band gap ($E_g \geq 2$ eV) II-VI compound (or other) semiconductor has been impurity-doped from the gas phase by pulsed-laser ablation (PLA). The maximum carrier concentrations also may be the highest obtained for ZnTe by any method thus far. Because pulsed laser deposition is inherently digital, attractive deposition rates can be combined with precise control of layer thickness in epitaxial multilayered structures. Typical deposition conditions are < 0.5 Å per laser pulse, with crystalline quality governed by tradeoffs between substrate temperature, pulse repetition rate, and the focused pulsed laser energy density. PLA's capability for growth of very thin epitaxial layers is being exploited and studied through growth of doped heteroepitaxial quantum well structures in the nearly lattice-matched ZnTe/CdSe// GaSb(substrate) system. Results obtained from growth and characterization of heterostructures in this system will be presented.

21647 (CONF-950865–2) **A background subtraction routine for enhancing energy-filtered plasmon images of $MgAl_2O_4$ implanted with Al^+ and Mg^+ ions.** Evans, N.D. (Oak Ridge Inst. for Science and Education, TN (United States)); Kenik, E.A.; Bentley, J.; Zinkle, S.J. Oak Ridge National Lab., TN (United States); Oak Ridge Inst. for Science and Education, TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00033. From 29. annual meeting of the Microbeam Analysis Society; Breckenridge, CO (United States); 6-11 Aug 1995. Order Number DE95012850. Source: OSTI; NTIS; INIS; GPO Dep.

$MgAl_2O_4$, a candidate fusion reactor material, was irradiated with Al^+ or Mg^+ ions; electron energy-loss spectra and energy-filtered plasmon images showed that metallic Al colloids are present in the ion-irradiated regions. This paper shows the subtraction of the spinel plasmon component in images using 15-eV-loss electrons in some detail.

21648 (DOE/ER/45361–3) **Deposition of a-SiC:H, a-SiO_2 and tetrahedral-C with programmable in-situ etching. Final performance report, March 1, 1988–November 30, 1991.** Collis, W.J. North Carolina Agricultural and Technical State Univ., Greensboro, NC (United States). Dept. of Electrical Engineering. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER45361. Order Number DE95012950. Source: OSTI; NTIS; GPO Dep.

This research program was originally defined to investigate the deposition of semiconductor and dielectric thin films using a low pressure remote plasma chemical vapor deposition system incorporating a process for etching the films. This etching was to be performed in a periodic fashion during the deposition process to remove defect regions in the film being deposited. The goal was to remove voids and other defects which are characteristic of low temperature deposition processes. While the original research proposal suggested that the studies include the amorphous alloys (Si/C):H and (Si/Ge):H, subsequent funding reductions limited the work to the deposition of an amorphous silicon alloy material (a-Si:H). Intrinsic and doped forms of these materials have applications in the fabrication of single and multi-junction thin film solar cells.

21649 (DOE/ER/45441–T1) **The heavy electron state. Final report, February 1, 1991–August 31, 1994.** Auerbach, A. Boston Univ., MA (United States). Dept. of Physics. 13 Feb 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER45441. Order Number DE95015113. Source: OSTI; NTIS; GPO Dep.

Theoretical studies of electron interactions in two families of novel materials were conducted. The temperature-concentration phase diagram of doped bismuthate superconductors was described using a coarse grained anisotropic Heisenberg model. A simplified model of electron interactions on buckminsterfullerene was studied. A simple model for electron-vibron interactions on charged buckminsterfullerene C_{60}^{n-}, was solved at both weak and strong couplings.

21650 (DOE/ER/45488–5) **Unusual behavior in the magnetic anisotropy of ultra-thin Co Sandwiches: The role of underlayers.** Marliere, C.; Engel, B.N.; Falco, C.M. Arizona Univ., Tucson, AZ (United States). Dept. of Physics. [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);Centre National de la Recherche Scientifique (CNRS), 75 - Paris (France);North Atlantic Treaty Organization, Brussels (Belgium). DOE Contract FG03-93ER45488. (CONF-940829–4: 14. international colloquium on magnetic films and surfaces. Duesseldorf (Germany), 29 Aug - 2 sep 1994). Order Number DE95010612. Source: OSTI; NTIS; GPO Dep.

We have used it situ polar Kerr effect measurements to study tile magnetic anisotropy of X/Co/Y sandwich structures grown by MBE on Cu(111) buffers, where X and Y are variable thicknesses of Au. For fixed values of Y and in the case of an underlayer wedge, e.g. variable X value, we have found a sharp minimum in both coercive field and perpendicular anisotropy at ≈ 1 atomic layer of the Au underlayer. This anisotropy behavior is opposite to that of an Au overlayer deposited on a Co film, i.e. variable Y and fixed X.

21651 (DOE/ER/45531–1) **High-resolution magnetic imaging and investigations of thin-film magnetism with spin-polarized electron, ion and atom probes. Progress report, November 1, 1994–October 31, 1995.** Walters, G.K.; Dunning, F.B. Rice Univ., Houston, TX (United States). Apr 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-95ER45531. Order Number DE95012190. Source: OSTI; NTIS; INIS; GPO Dep.

This is a progress report for the period 1 November, 1994 to 31 October, 1995. Research during this grant year includes: (1) Completion of the Spin-Polarized Electron Energy Loss Spectroscopy (SPEELS) research program. (2) Design of an improved and much more intense metastable atom source that can also be converted to a Rydberg atom beam, for continuing studies utilizing Spin-Polarized Metastable (Atom) Deexcitation Spectroscopy (SPMDS), and to initiate new investigations of interactions of Rydberg atoms with surfaces. (3) Development of a spin-polarized He^+ ion source for studies of ion-surface interaction dynamics and epitaxially grown magnetic films utilizing Spin-Polarized Ion Neutralization Spectroscopy (SPINS).

21652 (FEI–2373) **Fluctuating spectroscopy of boron nitride graphite-like materials.** Stepanov, V.A.; Stepanov, P.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 14p. (In Russian). Order Number DE95633166. Source: OSTI; NTIS (US Sales Only); INIS.

The Raman scattering and IR-reflection spectra of the materials based on graphite-like boron nitride are obtained. The BN-based materials are prepared by chemical vapor deposition (CVD) and reaction sintering. The long wavelength shifts of Raman bands and short wavelength shifts of IR bands are supposed to be caused by the formation of stacking faults in the hexagonal BN structure. The stacking faults concentration in boron nitride depends on the features of the preparing technologies. 8 refs.; 5 figs.; 1 tab.

21653 (HMI-B–523) **Gas transport in graphitic materials.** Hoinkis, E. Hahn-Meitner-Institut Berlin GmbH (Germany). Feb 1995. 56p. Order Number DE95785376. Source: OSTI; NTIS (US Sales Only); INIS.

The characterization of the gas transport properties of porous solids is of interest in several fields of science and technology. Many catalysts, adsorbents, soils, graphites and carbons are porous. The gas transport through most porous solids can be well described by the dusty gas model invented by Evans, Watson and Mason. This model includes all modes of gas tranport under steady-state conditions, which are Knudsen diffusion, combined Knudsen/continuum diffusion and continuum diffusion, both for gas pairs with equal and different molecular weights. In the absence of a pressure difference gas transport in a pore system can be described by the combined Knudsen/continuum diffusion coefficient D_1 for component 1 in the pores, the Knudsen diffusion coefficient D_{1K} in the pores, and the continuum diffusion coefficient D_{12} for a binary mixture in the pores. The resistance to stationary continuum diffusion of the pores is characterized by a geometrical factor $(\epsilon/\tau) < 1$, where ϵ is that part of the accessible porosity which is actually involved in steady state gas transport. ϵ/τ has been termed porosity to tortuosity ratio and is defined by $D_{12} = (\epsilon/\tau)D_{12}$, were D_{12} is the continuum diffusion coefficient for a binary mixture in free space. The Wicke-Kallenbach method was often used to measure D_1 as function of pressure. D_{12} and D_{1K} can be derived from a plot $1/D_1$ vs P, and ϵ/τ can be calculated since D_{12} is known. D_{1K} and the volume of dead end pores can be derived from transient measurements of the diffusional flux at low pressures. From D_{1K} the expression (ϵ/τ^c) anti l_{por} may be calculated, which characterizes the pore system for molecular diffusion, where collisions with the pore walls are predominant. (orig.)

21654 (LA-UR–95-1168) **Stress relaxation in discontinuously reinforced composites.** Shi, N. (Los Alamos National Lab., NM (United States)); Arsenault, R.J. Los Alamos National Lab., NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. GRANT N00014-91-J-1353. (CONF-9506181–1: Micromechanics and constitutive modeling of composite materials, Los Angeles, CA (United States), 28-30 Jun 1995). Order Number DE95010928. Source: OSTI; NTIS; GPO Dep.

It has been observed that in discontinuously-reinforced Al_2O_3/NiAl composites that as the reinforcement size increases the average density of dislocations generated from the relaxation of the thermal stresses increases, and the corresponding thermal residual stresses slightly decrease. Similar changes result when the reinforcement morphology changes from spheres to short fibers to continuous filaments. The changes of dislocation density and thermal residual stresses with respect to particle size are in contrast to those observed in the SiC/Al counterpart A previously developed simple model used to explain the SiC/Al data, which was based on prismatic dislocation punching, suggested that the density of the misfit dislocations decreases when the reinforcement size increases. In this investigation, a simple model is proposed to explain the anomaly in the development of thermal residual stresses and the generation of misfit dislocations as a function of the particle size and shape in Al_2O_3/NiAl composites. As a result of a lack of sufficient independent-slip-systems in low symmetry materials such as NiAl, plastic relaxation of the thermal stresses is severely constrained as compared to fcc Al. As such, plastic relaxation requires collaborative slips in an aggregate of grains. This only occurs when the length scale of the varying misfit thermal stress field is much larger than the average grain size. That is, the mechanism of plastic relaxation becomes operative when the reinforcement size increases.

21655 (LA-UR–95-1543) **Lattice polymer automata.** Rasmussen, S. (Los Alamos National Lab., NM (United States)); Smith, J.R. Los Alamos National Lab., NM (United States). [1995]. 27p. Sponsored by USDOE, Washington, DC (United States);Santa Fe Inst., NM (United States). DOE Contract W-7405-ENG-36. (CONF-9404261–1: Self-organization of biopolymers, Jena (Germany), 10-13 Apr 1994). Order Number DE95011980. Source: OSTI; NTIS; GPO Dep.

We present a new style of molecular dynamics and self-assembly simulation, the Lattice Polymer Automaton (LPA). In the LPA all interactions, including electromagnetic forces, are decomposed and communicated via propagating particles, "photons." The monomer-monomer bondforces, the molecular excluded volume forces, the longer range intermolecular forces, and the polymer-solvent interactions may all be modeled with propagating particles. The LPA approach differs significantly from both of the standard approaches, Monte Carlo lattice methods and Molecular Dynamics simulations. On the one hand, the LPA provides more realism than Monte Carlo methods, because it produces a time series of configurations of a single molecule, rather than a set of causally unrelated samples from a distribution of configurations. The LPA can therefore be used directly to study dynamical properties; one can in fact watch polymers move in real time. On the other hand, the LPA is fully discrete, and therefore much simpler than traditional Molecular Dynamics models, which are continuous and operate on much shorter time scales. Due to this simplicity it is possible to simulate longer real time periods, which should enable the study of molecular self-organization on workstations supercomputers are not needed.

21656 (LA-UR–95-1555) **Magnetostriction and thermal expansion of the Kondo semiconductor $Ce_3Bi_4Pt_3$.** Hundley, M.F. (Los Alamos National Lab., NM (United States)); Neumeier, J.J.; Thompson, J.D.; Lacerda, A.; Canfield, P.C. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9505186–1: 2. physical phenomena at high magnetic fields conference, Tallahassee, FL (United States), 6-9 May 1995). Order Number DE95011975. Source: OSTI; NTIS; GPO Dep.

We report dilatometric thermal expansion (α) and magnetostriction (λ) measurements on the Kondo semiconductor $Ce_3Bi_4Pt_3$ and its non-magnetic analog $La_3Bi_4Pt_3$ in fields to 100 kOe. The magnetic contribution to the thermal expansion of $Ce_3Bi_4Pt_3$ displays a broad maximum centered at 50 K, close to the temperature where the 4f specific heat is a maximum. The linear magnetostriction is anomalously large in $Ce_3Bi_4Pt_3$, with values that are characteristic of mixed-valent compounds ($\lambda_\perp = 3.26\times10^{-5}$, $\lambda_\parallel = -6.24\times10^{-5}$ in 100 kOe at 4 K). The volume magnetostriction is positive and a factor of ten smaller than the linear coefficients ($\lambda_V = 2.75\times10^{-6}$ in 100 kOe at 4 K). The volume magnetostriction is temperature-dependent, and peaks at 50 K. The data are considered in terms of a Grueneisen analysis that links the temperature-dependent magnetic susceptibility, thermal expansion, magnetostriction, bulk modulus, and specific heat of $Ce_3Bi_4Pt_3$ via temperature-dependent electronic and magnetic scaling parameters.

21657 (LBL–34499) **Scanning tunneling microscopy of Si donors in GaAs.** Zheng, J.F. (California Univ., Berkeley, CA (United States). Dept. of Materials Science); Weber, E.R.; Liu, X.; Newman, N.; Ogletree, D.F.; Salmeron, M.B. Lawrence Berkeley Lab., CA (United States). Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9307124–4: 17. international conference on defects in semiconductors, Gmunden (Austria), 18-23 Jul 1993). Order Number DE95011266. Source: OSTI; NTIS; GPO Dep.

Using scanning tunneling microscopy, we have identified and characterized Si donors (Si_{Ga}) in GaAs located on the (110) surface and in subsurface layers. Si_{Ga} on the surface shows localized features with characteristic structures in good agreement with a recent theoretical calculation. Si_{Ga} in subsurface layers appears as delocalized protrusions superimposed on the background lattice, which are interpreted in terms of the modification of the tunneling due to the tip-induced band bending perturbed by the Si_{Ga} Coulomb potential.

21658 (LBL–36696) **Charge-transfer gap closure in transition-metal halides under pressure.** Chen, A.L.; Yu, P.Y. Lawrence Berkeley Lab., CA (United States). Jan 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95011268. Source: OSTI; NTIS; GPO Dep.

Insulator-to-metal transition induced by pressure has been studied in three transition metal iodides: NiI_2, CoI_2 and FeI_2 using optical absorption and resistivity measurements at room temperature. Comparisons between the results obtained by these two techniques suggested that the closure of the charge-transfer gap is the principal mechanism responsible for the insulator-to-metal transition in these materials.

21659 (LBL–36900) **Predicting the transport properties of sedimentary rocks from microstructure.** Schlueter, E.M. Lawrence Livermore National Lab., CA (United States). ©Jan 1995. 299p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14475. Order Number DE95012363. Source: OSTI; NTIS; GPO Dep.

Understanding transport properties of sedimentary rocks, including permeability, relative permeability, and electrical conductivity, is of great importance for petroleum engineering, waste isolation, environmental restoration, and other applications. These transport properties axe controlled to a great extent by the pore structure. How pore geometry, topology, and the physics and chemistry of mineral-fluid and fluid-fluid interactions affect the flow of fluids through consolidated/partially consolidated porous media are investigated analytically and experimentally. Hydraulic and electrical conductivity of sedimentary rocks are predicted from the microscopic geometry of the pore space. Cross-sectional areas and perimeters of individual pores are estimated from two-dimensional scanning electron microscope (SEM) photomicrographs of rock sections. Results, using Berea, Boise, Massilon, and Saint-Gilles sandstones show close agreement between the predicted and measured permeabilities. Good to fair agreement is found in the case of electrical conductivity. In particular, good agreement is found for a poorly cemented rock such as Saint-Gilles sandstone, whereas the agreement is not very good for well-cemented rocks. The possible reasons for this are investigated. The surface conductance contribution of clay minerals to the overall electrical conductivity is assessed. The effect of partial hydrocarbon saturation on overall rock conductivity, and on the Archie saturation exponent, is discussed. The region of validity of the well-known Kozeny-Carman permeability formulae for consolidated porous media and their relationship to the microscopic spatial variations of channel dimensions are established. It is found that the permeabilities predicted by the Kozeny-Carman equations are valid within a factor of three of the observed values methods.

21660 (LBL–36903) **Predicting the permeability of sedimentary rocks from microstructure.** Schlueter, E.M. Lawrence Berkeley Lab., CA (United States); California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering. Jan 1995. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ; AC22-89BC14475. Order Number DE95012757. Source: OSTI; NTIS; GPO Dep.

Permeability is linked to other properties of porous media such as capillary pressure and relative permeability. In order to understand the relationships, one has to understand how all those properties are conditioned by the connectivity and geometrical properties of the pore space. In this study, we look at a natural porous material which is defined as a two-phase material in which the interconnected pore space constitutes one phase and the solid matrix the other. Laboratory samples are tested using fluid flow experiments to determine the relationship of macroscopic properties such as permeability to rock microstructure. Kozeny-Carman and other equations are developed to further quantify these relationships.

21661 (LBL–36909) **Size, shape, and crystallinity of luminescent structures in oxidized Si nanoclusters and H-passivated porous Si.** Schuppler, S. (AT&T Bell Labs., Murray Hill, NJ (United States)); Marcus, M.A.; Xie, Y.H.; Harris, T.D.; Brown, W.L.; Chabal, Y.J.; Szajowski, P.J.; Friedman, S.L.; Adler, D.L.; Ross, F.M. Lawrence Berkeley Lab., CA (United States). Nov 1994. 9p. Sponsored by USDOE, Washington, DC (United States);Alexander von Humboldt-Stiftung, Bonn (Germany). DOE Contract AC03-76SF00098. (CONF-941144–157: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95012322. Source: OSTI; NTIS; GPO Dep.

Near-edge and extended x-ray absorption fine structure measurements from a wide variety of H-passivated porous Si samples and oxidized Si nanocrystals, combined with electron microscopy, ir-absorption, α-recoil, and luminescence emission data, provide a consistent structural picture of the species responsible for the luminescence observed in these systems. For luminescent porous Si samples peaking in the visible region, i. e., $\leq$700nm, their mass-weighted-average structures are determined here to be particles - not wires, whose short-range character is crystalline - not amorphous, and whose dimensions - typically $<$15 Å - are significantly smaller than previously reported or proposed. These results depend only on sample luminescence behavior, not on sample preparation details, and thus have general implications in describing the mechanism responsible for visible luminescence in porous silicon. New results are also presented which demonstrate that the observed luminescence is unrelated to either the photo-oxidized Si species in porous Si or the interfacial suboxide species in the Si nanocrystals.

21662 (LBL–36911) **X-ray absorption spectroscopy from H-passivated porous Si and oxidized Si nanocrystals.** Schuppler, S. (AT and T Bell Labs., Murray Hill, NJ (United States)); Marcus, M.A.; Friedman, S.L. Lawrence Berkeley Lab., CA (United States). Nov 1994. 11p. Sponsored by USDOE, Washington, DC (United States);Alexander von Humboldt-Stiftung, Bonn (Germany). DOE Contract AC03-76SF00098. (CONF-941144–149: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95012352. Source: OSTI; NTIS; GPO Dep.

Quantum confinement in nanoscale Si structures is widely believed to be responsible for the visible luminescence observed from anodically etched porous silicon (por-Si), but little is known about the actual size or shape of these structures. Extended x-ray absorption fine structure data from a wide variety of por-Si samples show significantly reduced average Si coordination numbers due to the sizable contribution of surface-coordinated H. (The IUSI ratios, as large as 1.2, were independently confirmed by ir-absorption and α-recoil measurements.) The Si coordinations imply very large surface/volume ratios, enabling the average Si structures to be identified as crystalline particles (not wires) whose dimensions are typically $<$15 Å. Comparison of the size-dependent peak luminescence energies with those of oxidized Si nanocrystals, whose shapes are known, shows remarkable agreement. Furthermore, near-edge x-ray absorption fine structure measurements of the nanocrystals shows the outer oxide and interfacial suboxide layers to be constant over a wide range of nanocrystal sizes. The combination of these results effectively rules out surface species as being responsible for the observed visible luminescence in por-Si, and strongly supports quantum confinement as the dominant mechanism occurring in Si particles which are substantially smaller than previously reported or proposed.

21663 (LBL–36971) **Investigation of exfoliation joints in Navajo sandstone at the Zion National Park and in granite at the Yosemite National Park by tectonofractographic techniques.** Bahat, D.; Grossenbacher, K.; Karasaki, K. Lawrence Berkeley Lab., CA (United States). Apr 1995. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012362. Source: OSTI; NTIS; GPO Dep.

Tectonofractographic techniques have been applied to the study of joint exfoliation in the Navajo sandstone at Zion National Park and in the granite at Yosemite National Park. New types of fracture surface morphologies have been observed which enabled the discerning of incipient joints and consequent fracture growth in these rocks. Incipient jointing in the sandstone is mostly manifested by elliptical and circular fractures (meters to tens meters across) initiating from independent origins. They interfere with each other and grow to larger circular fractures producing exfoliation surfaces up to hundreds of meters across. Less frequently, series of large concentric undulations demonstrate the propagation of a large fracture

front producing exfoliation from an individual origin. One such fracture front reveals refraction of undulations at a layer boundary. Certain en echelon fringes surround the joint mirror plane with well defined rims of en echelons and hackles which enable the determination of the tensile fracture stress, σf. Arches in Zion National Park are ubiquitous in shape and size, revealing stages in their evolution by a mechanical process, which was associated with exfoliation, but independent of local faulting. Exfoliation and arching mostly occurred on vertical surfaces of N-NNW and NE sets of prominent joints, but there are also deviations from this general trend. In Yosemite National Park large exfoliations (hundreds of meters in size) developed on the El Capitan cliff by the interaction and merging of many previous smaller incipient joints that vary in size from meters to tens of meter.

21664 (LBL–37086) **Dynamic observation of electrochemical etching in silicon.** Ross, F.M. (Lawrence Berkeley Lab., CA (United States). National Center for Electron Microscopy); Searson, P.C. Lawrence Berkeley Lab., CA (United States). Mar 1995. 4p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant DMR-9202645. (CONF-9503125–2: 9. international conference on microscopy of semiconducting materials, Oxford (United Kingdom), 20-23 Mar 1995). Order Number DE95012359. Source: OSTI; NTIS; GPO Dep.

The authors have designed and constructed a TEM specimen holder in order to observe the process of pore formation in silicon. The holder incorporates electrical feedthroughs and a sealed reservoir for the electrolyte and accepts lithographically patterned silicon specimens. The authors describe the system and present preliminary, ex situ observations of the etching process.

21665 (NEI-DK–2013) **Polyurethane foam without ozone depleting substances. Experience from Danish industry.** Arbejdsrapport fra Miljoestyrelsen, 62. Pedersen, P.H. (Danish Environmental Protection Agency (Denmark)); Mogensen, L. Miljoestyrelsen, Copenhagen (Denmark). Dec 1994. 80p. Order Number DE95779223. Source: OSTI; NTIS.

Traditionally Danish industry has a high production of polyurethane foam due to the substantial production and export of product like domestic refrigerators and freezers, district heating pipes, joint foam, sandwich insulation panels etc. Experience from Danish industrial projects show that it is possible to produce many kinds of polyurethane foam without ozone depleting substances or substances that contribute to global warming. Two major producers of domestic refrigerators and freezers have changed to cyclopentane blown insulation foam. Four companies, covering more than half of the world production of preinsulated district heating pipes, have developed new pipes where the insulating foam is blown with cyclopentane or similar technology. Sandwich insulating panels blown with water, creating CO_2, can be used with good results. Joint foam has been produced with propane/butane as blowing agent for the Scandinavian market since 1987. Flexible integral foam has been developed, using isopentane as a blowing agent. This development has been encouraged by the Danish phasing-out strategy consisting of three instruments: a tax on CFC and halon, a statutory order gradually banning the use of ODS for specific purposes and a development programme to support non-ODS technology. The developed technologies have been taken into production and shown that in most polyurethane foam production there is no need for substances that deplete the ozone layer or contribute to the global warming. (au)

21666 (NILU-F–18/94) **EUROCARE and classification of environmental aggressivity in Europe.** Haagenrud, S. Norsk Inst. for Luftforskning, Kjeller (Norway). Aug 1994. 27p. (CONF-9406336–1: Vision EUREKA conference on new technology for management and maintenance of Europe's old and new built environment, Hamar (Norway), 13-16 Jun 1994). Order Number DE95779280. Source: OSTI; NTIS.

The publication describes briefly aims and strategies of the EUREKA Umbrella EUROCARE. 17 EUREKA countries and CEC are now participating in the umbrella, which aims at facilitating and promoting market oriented EUREKA projects to counter-act the degradation of Europe's built environment, including the cultural heritage and within a sustainable development context. The strategic goal of these projects is to increase the service life of the built environment and decrease the yearly life cycle costs for its conservation, restoration and maintenance. So far more than 30 EUREKA projects are running. 7 refs., 8 figs.

21667 (ORNL/SUB–87-00184/05) **Gas transport model for chemical vapor infiltration. Topical report.** Starr, T.L. (Georgia Institute of Technology, Atlanta, GA (United States). School of Materials Science and Engineering). Oak Ridge National Lab., TN (United States); Georgia Inst. of Tech., Atlanta, GA (United States). School of Materials Science and Engineering. May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012163. Source: OSTI; NTIS; GPO Dep.

A node-bond percolation model is presented for the gas permeability and pore surface area of the coarse porosity in woven fiber structures during densification by chemical vapor infiltration (CVI). Model parameters include the number of nodes per unit volume and their spatial distribution, and the node and bond radii and their variability. These parameters relate directly to structural features of the weave. Some uncertainty exists in the proper partition of the porosity between "node" and'bond" and between intra-tow and inter-tow, although the total is constrained by the known fiber loading in the structure. Applied to cloth layup preforms the model gives good agreement with the limited number of available measurements.

21668 (PNL-SA–25157) **Vacuum deposited polymer films: Past, present, and future applications.** Affinito, J.; Martin, P.; Gross, M.; Bennett, W. Pacific Northwest Lab., Richland, WA (United States). Nov 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9411174–2: 8. international vacuum web coating conference, Las Vegas, NV (United States), 6-8 Nov 1994). Order Number DE95012397. Source: OSTI; NTIS; GPO Dep.

Two extremely high rate processes have been developed for the vacuum deposition of polymer thin films. Dubbed the PML (for Polymer Multi-Layer) and LML (for Liquid Multi-Layer) processes, the PML technique was originally developed for the manufacture of polymer/aluminum surface mount capacitors while the LML method arose from a need to fabricate lithium polymer batteries. These processes have since been found to be compatible with most other vacuum deposition techniques in, integrated, in-line coating processes. Battelle has developed an extensive program, and a great deal of hardware, to pursue a wide variety of PML and LML applications which integrate these two process technologies with other, conventional, vacuum deposition methods. The historical development of the technologies is reviewed and the Battelle PML/LML facilities are described. Current Battelle work involving solar thermal control films, PML QWOTs, and polymer/metal high reflectors are also discussed. Battelle PML work that is just starting, involving non-linear optical materials/devices, lithium polymer battery fabrication, electrochromic devices, and polymer/oxide multilayers, is discussed as well.

21669 (PNL–SA-25926) **Multilayer coatings on flexible substrates.** Martin, P.M.; Affinito, J.D.; Gross, M.E.; Coronado, C.A.; Bennett, W.D.; Stewart, D.C. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504155–2: 38. annual technical conference of the Society of Vacuum Coaters, Chicago, IL (United States), 2-7 Apr 1995). Order Number DE95011410. Source: OSTI; NTIS; GPO Dep.

Thin-film optical and non-optical multilayer coatings are deposited onto flexible substrates using a vacuum web coater developed at Pacific Northwest Laboratory. The coater's primary application is rapid prototyping of multilayer (1) polymer coatings, (2) polymer/metal coatings, (3) ceramic/metal coatings, and (4) hybrid polymer, ceramic, and metal coatings. The coater is fully automated and incorporates polymer evaporation and extrusion heads, high-rate magnetron sputtering cathodes, and e-beam evaporation sources. Polymer electrolytes are deposited by extrusion techniques. Flexible plastic, metal, and ceramic substrates can be coated using roll-to-roll or closed-loop configurations. Examples of multilayer optical coatings demonstrated to date are solar reflectors, heat mirrors, Fabry-Perot filters, and alpha particle

sensors. Nonoptical coatings include multilayer magnetic metal/ceramic and lamellar composites.

21670 (SAND–94-3248) **Final report on LDRD Project: Quantum confinement and light emission in silicon nanostructures.** Guilinger, T.R. (and others); Kelly, M.J.; Follstaedt, D.M. Sandia National Labs., Albuquerque, NM (United States). Feb 1995. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011010. Source: OSTI; NTIS; GPO Dep.

Electrochemically formed porous silicon (PS) was reported in 1991 to exhibit visible photoluminescence. This discovery could lead to the use of integrated silicon-based optoelectronic devices. This LDRD addressed two general goals for optical emission from Si: (1) investigate the mechanisms responsible for light emission, and (2) tailor the microstructure and composition of the Si to obtain photoemission suitable for working devices. PS formation, composition, morphology, and microstructure have been under investigation at Sandia for the past ten years for applications in silicon-on-insulator microelectronics, micromachining, and chemical sensors. The authors used this expertise to form luminescent PS at a variety of wavelengths and have used analytical techniques such as in situ Raman and X-ray reflectivity to investigate the luminescence mechanism and quantify the properties of the porous silicon layer. Further, their experience with ion implantation in Si lead to an investigation into alternate methods of producing Si nanostructures that visibly luminesce.

21671 (SAND–94-8779C) **Recent results in the devleopment of an integrated EUVL laboratory tool.** Tichenor, D.A. (and others); Kubiak, G.D.; Haney, S.J. Sandia National Labs., Livermore, CA (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950226–48: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95010756. Source: OSTI; NTIS; GPO Dep.

The demand for smaller critical dimensions in advanced computer chips has driven projection lithography to shorter wavelengths. Deep ultraviolet systems, operating at 248 nm, are commercially available and 193 nm lithography is under development. This paper describes a research and development program to extend this trend to extreme ultraviolet (EUV) wavelengths, in the range of 11 nm to 14 nm. Research and development activities are concentrated in four major areas: (1) aspheric reflectors required in an advanced EUV camera, (2) surface-imaging resists having the required resolution and sensitivity, (3) defect-free reflecting substrates required for mask fabrication, and (4) a compact source of EUV radiation. Each of these issues is discussed and efforts to address them are described. An intermediate EUVL laboratory tool, currently under construction, will also be described. This system uses a 10 × reduction Schwarzschild camera and a magnetically levitated wafer stage driven by a digital feedback controller. This system represents the first attempt at integrating all major subsystems into an EUVL laboratory tool, suitable for use in device fabrication experiments.

21672 (SAND–95-0848C) **Fundamental surface chemistry of GaAs OMVPE.** Creighton, J.R.; Truong, C.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505216–1: US/Japan workshop on atomic scale mechanisms of epitaxial growth, Honolulu, HI (United States), 10-12 May 1995). Order Number DE95011606. Source: OSTI; NTIS; GPO Dep.

Organometallic and hydride compounds are widely used as precursors for the epitaxial growth of GaAs and other compound semiconductors. These precursors are most commonly used to perform organometallic vapor phase epitaxy (OMVPE) and also in related deposition techniques such as atomic layer epitaxy (ALE) and metalorganic molecular beam epitaxy (MOMBE). We have investigated the surface chemical properties of these precursors on GaAs(100) using a variety of surface science diagnostics. Results have shed light on the mechanisms of precursor decomposition which lead to film growth and carbon doping. For instance, kinetics of trimethylgallium (TMGa) decomposition on the Ga-rich and As-rich surfaces, measured by TPD, are in semiquantitative agreement with ALE results; indicating that the dominant growth mechanism during ALE is heterogeneous. Furthermore, there is no compelling evidence for the production of methane (CH_4) on the GaAs surface when TMGa and arsine (AsH_3) are coadsorbed.

21673 (SAND–95-0979C) **Enhancement of surface processes with low energy ions.** Chason, E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505211–2: DOE Council on Materials conference on new directions for ion beams in semiconductor processing, Santa Fe, NM (United States), 4-7 May 1995). Order Number DE95011605. Source: OSTI; NTIS; GPO Dep.

Continuing trends in device fabrication towards smaller feature sizes, lower thermal budgets and advanced device structures put greater emphasis on controlling the surface structure and reactivity during processing. Since the evolution of the semiconductor surface during processing is determined by the interaction of multiple surface processes, understanding how to control and modify these processes on the atomic level would enable us to exert greater control over the resulting morphology and composition. Low energy ions represent one method for bringing controlled amounts of energy to the surface to modify surface structure and kinetics. The kinetic energy deposited by the ions can break bonds and displace atoms, creating defect populations significantly in excess of the equilibrium concentration. Consequences of these non-equilibrium conditions include the enhancement of surface kinetic processes, increased surface reactivity and formation of metastable structures and compositions. These effects can be beneficial (ion enhanced mass transport can lead to surface smoothing) or they can be detrimental (residual defects can degrade electrical properties or lead to amorphization). The net results depend on a complex balance that depends on many parameters including ion mass, energy, flux and temperature. In the following section, we review progress both in our fundamental understanding of the production of low-energy ion-induced defects and in the use of low energy ions to enhance surface morphology, stimulate low temperature growth and obtain non-equilibrium structures and compositions.

21674 (UCRL-JC–118776) **AFM studies of a new type of radiation defect on mica surfaces caused by highly charged ion impact.** Ruehlicke, C. (Lawrence Livermore National Lab., CA (United States)); Briere, M.A.; Schneider, D. Lawrence Livermore National Lab., CA (United States). 28 Sep 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941129–24: 13. international conference on the application of accelerators in research and industry, Denton, TX (United States), 7-10 Nov 1994). Order Number DE95011536. Source: OSTI; NTIS; INIS; GPO Dep.

Radiation induced defects on mica caused by the impact of slow very highly charged ions (SVHCI) have been investigated with an atomic force microscope (AFM). Freshly cleaved surfaces of different types of muscovite were irradiated with SVHCI extracted from the LLNL electron beam ion trap (EBIT) at velocities of ca. 2 keV/amu. Atomic force microscopy of the surface reveals the formation of blisterlike defects associated with single ion impact. The determined defect volume which appears to increase linearly with the incident charge state and exhibits a threshold incident charge state has been determined using the AFM. These results indicate that target atoms are subjected to mutual electrostatic repulsion due to ionization through potential electron emission upon approach of the ion. If the repulsion leads to permanent atomic displacement, surface defects are formed.

21675 (UCRL-JC–119412) **Extrinsic fracture mechanisms in two laminated metal composites.** Lesuer, D.; Syn, C.; Riddle, R.; Sherby, O. Lawrence Livermore National Lab., CA (United States). 29 Nov 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950201–16: Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS), Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95011737. Source: OSTI; NTIS; GPO Dep.

The crack growth behavior and fracture toughness of two laminated metal composites (6090/SiC/25p laminated with 5182 and ultrahigh-carbon steel laminated with brass) have been studied in

both "crack arrester" and "crack divider" orientations. The mechanisms of crack growth were analyzed and extrinsic toughening mechanisms were found to contribute significantly to the toughness. The influence of laminate architecture (layer thickness and component volume function), component material properties and residual stress on these mechanisms and the resulting crack growth resistance are discussed.

21676 (VTT-PUB–221) **Allowable stresses in FRP marine vessels.** Visuri, M. (VTT Manufacturing Technology, Espoo (Finland). Marine and Mechanical Engineering). Technical Research Centre of Finland, Espoo (Finland). 1995. 117p. Order Number DE95779236. Source: OSTI; NTIS.

The publication consists of a literature survey of allowable stresses used in fibre-reinforced plastic (FRP) structures, and a new method for the determination of allowable stresses is presented. In the literature survey, primary attention has been paid to the marine industry (including classification societies), the aerospace industry, and to pressure vessel and pipe standards. Generally the subject is only briefly discussed in the literature. This is a drawback, since the conservatism dominating the rules used today often means unnecessary weight penalties. High factors of safety (FoS), except in the aerospace industry, are used in most designs. The short experience of structures in service, wide variety of material combinations and the rather complicated mechanical behaviour are the most important factors in this regard. The presented determination method for allowable stresses aims at introducing a more rational way for dimensioning. The method is based on the partial factors of safety concept. A statistical analysis can be included for better accuracy. This requires enough data of material and load behaviour. The method is flexible and can be tailored to various needs. One major drawback is the lack of information concerning material behaviour under long-term loads. The method is aimed to be expanded in the future. (orig.)

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21677 (ANL/CHM/CP–85869) **The nature and fate of natural resins in the geosphere VI. Analysis of fossil resins from Axel Heiberg Island Canadian Arctic.** Anderson, K.B. (Argonne National Lab., IL (United States)); LePage, B.A. Argonne National Lab., IL (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States);Department of Indian Affairs and Northern Development, Ottawa, ON (Canada);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada). DOE Contract W-31109-ENG-38. (CONF-940813–41: 208. American Chemical Society national meeting, Washington, DC (United States), 21-26 Aug 1994). Order Number DE95012212. Source: OSTI; NTIS; GPO Dep.

Ambers are well known and abundant in terrestrial sediments all over the world; however, due largely to the absence of definite morphological characteristics, the precise botanical origin of most amber samples, are at best, often a matter of speculation. This has severely restricted the usefulness of amber in paleobotanical and paleoecological interpretations. The molecular composition and structural characteristics of fossil resins however, may preserve evidence of their botanical origin, which could be of great value in both geochemical, paleobotanical, and paleoenvironmental studies. The remains of a number of exceptionally well-preserved Taxodiaceae-dominated swamp-forest communities have been identified in the sediments of the middle Eocene (45 million years old) Buchanan Lake Formation of Axel Heiberg Island, Canadian Arctic Archipelago. The amber collected from these ancient in situ forests provides a unique opportunity to characterize these resins chemically and taxonomically. Resinite associated with Metasequoia, Pinus and Pseudolarix has been characterized using Pyrolysis-Gas Chromatography-Mass Spectrometry. This method provides a direct analysis of the molecular structure and composition of the resin. In several cases, both bled resin and cone-resin samples have been characterized. The results of these analyses are presented and discussed. The implications of these results for the botanical origins of other ambers represented in the fossil record (including succinite) will also be discussed.

21678 (ANL/FE/CP–83609) **Analysis of metallic fuels by laser ablation.** Johnson, S.G. (Argonne National Lab., Idaho Falls, ID (United States)); Goodall, P.S.; Wood, E.L.; Kimbrell, S.M. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950226–50: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95012465. Source: OSTI; NTIS; GPO Dep.

A hot cell-based solid sampling system has been developed for application to the analyses of irradiated materials such as metallic reactor fuel from a nuclear reactor, and radioactive waste forms. This system employs one of two sampling techniques, glow discharge or laser ablation, for introduction of material into one of two instruments for analysis, either a time of flight mass spectrometer or an inductively coupled argon plasma-atomic emission spectrometer (ICP-AES). This paper will discuss using ICP-AES for the analysis of major, minor and trace constituents in an unirradiated U-10 wt % Zr metallic reactor fuel. The behavior of highly refractory elements, such as Zr, in the laser ablation process will be examined in detail. Additional corroborative data provided via scanning electron microscopy-energy dispersive x-ray fluorescence spectroscopy (SEM-EDS) will be presented.

21679 (CONF-950865–1) **The self-supporting disc: A specimen geometry exhibiting low secondary characteristic fluorescence.** Anderson, I.M. (Oak Ridge National Lab., TN (United States). Metals and Ceramics Div.); Bentley, J.; Carter, C.B. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-76OR00033 ; AC05-84OR21400. Grant DMR-8901218. From 29. annual meeting of the Microbeam Analysis Society; Breckenridge, CO (United States); 6-11 Aug 1995. Order Number DE95012849. Source: OSTI; NTIS; GPO Dep.

Secondary characteristic fluorescence, when expressed relative to the primary intensity of the fluorescing element, can be written as the product of three factors, which represent the probabilities of the various processes that govern the magnitude of fluorescence and thus have values between zero and one. Two of these factors are characteristic of the material being analyzed. The factor $C_X{}^Y$ is the likelihood that the primary x ray of Y is absorbed by the element X if it is absorbed in the fluoresced volume of the specimen. The factor P_X is the probability that element X, having absorbed the primary x ray, emits the secondary x ray of interest. The third factor is the likelihood that the primary x ray is absorbed in the fluoresced volume, and is denoted $\Omega_{eff}/4\pi$. For critical microanalysis studies, thin-flake specimens are most desirable, especially if the size of individual flakes is small relative to the scale, ~10 μm, over which the primary x rays are typically absorbed. However, a specimen comprised of small flakes may be impractical for many studies. Such a geometry may not indicate the relative positions and orientations of important microstructural features. The lack of sampling volume may also inhibit microanalysis of a specific feature of the microstructure, such as an interface, which may not be represented within the small specimen volume. For such analyses, a specimen geometry that leaves the specimen intact, yet minimizes secondary fluorescence by virtue of having a small geometric factor, may be preferable. Because the geometric factor depends only on the absorption properties of the secondary x ray, a rule-of-thumb maximum secondary fluorescence of an elemental line can be calculated by assuming an extreme microanalysis situation: when the entire disc is composed of the fluoresced element.

21680 (CONF-950892–2) **Z-contrast imaging of catalysts in the 300 kV STEM.** Pennycook, S.J. (Oak Ridge National Lab., TN (United States)); Jesson, D.E.; Liu, D.R. Oak Ridge National Lab., TN (United States). Mar 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From

53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95012843. Source: OSTI; NTIS; GPO Dep.

Short communication. ELECTRON MICROSCOPY/image processing; PALLADIUM/electron microscopy; SCANNING ELECTRON MICROSCOPY; TRANSMISSION ELECTRON MICROSCOPY; SPATIAL RESOLUTION; PALLADIUM; METALS

21681 (DOE/ER/13770–T3) **Distributed measurements of tracer response on packed bed flows using a fiberoptic probe array. Final report.** Jones, M.C. (National Inst. of Standards and Technology, Boulder, CO (United States). Chemical Science and Technology Lab.); Nassimbene, R.; Wolfe, J.; Frederick, N. National Inst. of Standards and Technology, Boulder, CO (United States). Chemical Sciences and Technology Lab. 28 Oct 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-87ER13770. Order Number DE95013079. Source: OSTI; NTIS; GPO Dep.

Scale-up of packed bed processes, particularly those involving chromatographic separations, is made difficult by a seemingly inevitable increase in dispersion due to packing nonuniformity. To provide a suitable characterization, the authors measured the spatial distribution of dispersion and mixing in packed beds of uniform impervious spherical glass particles by a tracer impulse technique. The key feature in this work is the use of a fiberoptic array at the exit plane to obtain a time-resolved spatially distributed response. All experiments were in the creeping flow regime. The authors used a fluorescent dye with laser excitation through the fiber terminations in the bed. The fluoresced radiation was collected through the same fibers. They analyzed the data by the use of indices of the extent of micromixing based on Danckwerts's original degree of segregation and an additional index of structural uniformity. The computations involve a moment analysis of the individual and average probe responses. A simple model gives expressions for the indices in terms of the Peclet number and is shown to provide a useful limiting case. The computed indices are also shown to be very sensitive to adsorption of dye on the surface of the glass. However, for some of the experiments with the largest spheres using Pyrex glass, the effects of adsorption are indiscernible. This technique successfully separates the contribution of micromixed fluid to overall bed dispersion from the contribution due to the transverse variation of the flow residence time.

21682 (DOE/MC/27115–95/C0478) **Zeolite membranes for gas separations.** Falconer, J.; Noble, R. Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-90MC27115. (CONF-950494–20: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012984. Source: OSTI; NTIS; GPO Dep.

Silicalite-1, a pure silica zeolite, was deposited on a tubular, asymmetric, γ-alumina support. Single gas permeation experiments with N_2, CH_4, and CO_2 were carried out on the membrane. Separation experiments for N_2/CH_4 mixtures were also conducted. Single-gas permeation of H_2 and separation of H_2/SF_6 mixture were also carried out with the membrane. Composite membranes of silicalite and Ni-SAPO-34 were also fabricated, but no CO_2/H_2 selectivity was found. It is proposed to use these membranes for methanol synthesis and separation, and for separating H_2 from gasification products for use as fuel cell fuel, etc.

21683 (FZKA–5514) **Synthesis, characterization and optimization of siloxane polymer coatings for optical sensors based on absorption measurements in the evanescent field.** Zimmermann, B. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Chemie. Feb 1995. 152p. (In German). Order Number DE95779674. Source: OSTI; NTIS (US Sales Only).

In this work polysiloxanes with methyl and phenyl side chains were synthesized. The properties of this membranes had to be optimized for the application in optical sensors for monitoring nonpolar organic compounds in aqueous media. The sensing principle is based on the enrichment of these substances in the hydrophobic polysiloxane membrane and the measurement of their evanescent wave near-infrared (NIR) absorption spectra by means of a light conducting element, which is in contact with the membrane. For the preparation of the silicone membranes chainlike α, ω-dioles were synthesized by hydrolysis of dichlorodimethylsilane. This viscous and liquid dioles were cured to solid polymers by a condensation reaction. The synthesis of poly(dimethyl-co-methylphenylsiloxanes) with varying degrees of phenylation was carried out by reverse hydrolysis of dichlorodimethylsilane and dichloromethylphenylsilane. In this way it was possible to adjust the refractive index of the polymers which is dependent on the degree of phenylation. The degree of phenylation again can be easily varied through the stoichiometric portion of $(CH_3)(C_6H_5)SiCl_2$ in the starting mixture of the reactants. The siloxane as well as the enriched compounds show absorption bands in the same region of the NIR range. This leads to interferences in the spectral detection of the analyte. To avoid these interferences deuterated siloxane polymers were synthesized by reaction of $(CD_3)_2SiCl_2$ with methanol/acetic acid and curing of the diols by a condensation reaction. The characterization of the synthesized siloxane polymers was done by IR- and NIR-spectroscopy. Moreover, the ability of the siloxanes to enrich nonpolar organic substances out of aqueous solutions was examined. An improvement was achieved by insertion of phenyl side chains in the polysiloxane backbone. (Abstract Truncated)

21684 (INIS-JP–028, pp. 118-120) **Characterization of single crystalline semiconductors by RBS measurements.** Matsunami, Hiroyuki (Kyoto Univ. (Japan). Faculty of Engineering); Yoshimoto, Masahiro; Kimoto, Tsunenobu; Komatsu, Yuji; Itoh, Akira. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

Single crystalline SiC, GaP and InGaP were characterized by RBS (Rutherford Backscattering Spectroscopy) measurements. The surface damage introduced through polishing processes was analyzed in detail. The damaged layers could be removed by surface treatments such as reactive ion etching and thermal oxidation. The residual impurities in sublimation-grown SiC could be reduced significantly by using pure SiC sources. Crystallinity of GaP heteroepitaxially grown on Si was also examined by the channeling measurements. (author).

21685 (INIS-JP–028, pp. 121-122) **An investigation on the structure of semiconductor hetero interface by RBS and SR SAXS.** Okuda, Hiroshi (Kyoto Univ. (Japan). Faculty of Engineering); Vezin, V.; Osamura, Kozo. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

The structure of GaAs/Si and Ge/Si lattice-mismatched heterostructure has been investigated by synchrotron-radiation small-angle scattering(SR-SAXS) and RBS experiment. The small-angle scattering intensity profile obtained by using two-dimensional detector (imaging plate) has been interpreted in terms of the imperfect interface and lattice defect in the epitaxial layer. RBS experiments with 2MeV He^{2+} have been carried out to check the film thickness and the composition profile of the epitaxial layers. (author).

21686 (INIS-JP–028, pp. 133-135) **Elemental analyses of bulk and individual particles by PIXE and SEM-EDX.** Kasahara, Mikio (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy); Shinoda, Kazuyuki; Takahashi, Kanji; Yoshida, Kouji. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

The atmospheric aerosol samples were collected by a stacked filter method under the various environmental conditions. The elemental concentrations of aerosol particles were measured using PIXE analysis as a bulk sample. And also elemental compositions of about 200 individual particles per each sample were measured by SEM-EDX analysis. In this study, the correspondencies of analytical results measured by both analyses as well as chemical characteristics of individual and bulk aerosols were investigated. (author).

21687 (INIS-JP–028, pp. 136-137) **Determination of trace elements in woods.** Katayama, Yukio (Kyoto Univ. (Japan). Faculty of Agriculture); Anzai, Takao; Nishimura, Kazuo; Yomita, Michio. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

The particle induced X-ray emission(PIXE) method was applied to the analysis of the elements in tree rings of sugi(Cryptomeria japonica D.Don). The wood samples were collected from near the arsenic mine(Miyazaki prefecture), the copper mine and the antimony refinary(Shiga prefecture). Arsenic is hardly detectable in sugi grown up at the normal condition. However, in this case it was detected corresponding virtually to the period when the refinary had been in operation. (author).

21688 (INIS-JP–028, pp. 138-141) **Neuropathological changes of rabbit spinal motor neurons induced by retrograde axonal aluminum-uptake.** Yoshida, Sohei (Wakayama Medical Coll. (Japan)); Kihira, Tameko; Koumoto, Junko; Wakayama, Ikuro; Ishiguchi, Hiroshi; Nakagawa, Mari; Yase, Yoshiro; Sasajima, Kazuhisa; Yoshida, Kouichi. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

To examine pathological changes of spinal motor neurons induced by subepineurial injection of 10-500 μ1 of 2% $AlCl_3$ solution into a sciatic nerve of rabbits, histometric studies of chromatolytic neurons, spheroids/globules and degenerative neurons in the both lumbar anterior gray horn tissues was undertaken using routine and immunochemical staining methods. All these neuronal changes were reactive to the antineurofilament antibody (SM1). Except chromatolytic neurons, the appearance of spheroids/globules and degenerative neurons were significantly dose-responsive to the volume of injected 2% $AlCl_3$ solution. In this acute experiments, it is suggested that Al may primarily cause a disturbance of neurofilament transport in proximal axons, consequently leading to neurofibrillary degeneration of neurons. (author).

21689 (INIS-JP–029, pp. 138-139) **Qualitative and quantitative analyses of many metals by PIXE method.** Tazawa, Yuji (Kyoto Univ. (Japan). Dept. of Physics); Ogino, Koya; Tanimoto, Masao. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

PIXE(Particle induced X-ray Emission) Method was applied to both qualitative and quantitative analyses of many metals in sample. In this experiments, several samples have been tested for the next studies:(a)Abundances of trace elements in micro-particles collected from Antarctic ice and snow. (b)Abundances of trace elements such as Sulfur(S) and Chlorine(Cl) emitted from explosive volcanic eruption in tree-rings. (c)Decrease of S-metal sandwiched between thin Au foils. (author).

21690 (INIS-JP–029, pp. 147-149) **Evaluation of biological materials with PIXE analysis and RBS.** Tsuboi, Yoichi (Kyoto Univ. (Japan). Faculty of Medicine); Yokoe, Yoshihiko; Iizuka, Tadahiko. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

PIXE and RBS were applied to determine the composition of the surface TiO_2 layer of titanium implant and TiO_2 thin film prepared by Ion Beam Irradiation. The PIXE analysis of the oxide films determined, with high precision, the incorporation of impurities and the variation of the ratio of the constituent elements. The results of the present investigation showed that the PIXE analysis combined with RBS, can be effectively used for qualitative and quantitative analysis of thin film on the surface and in the film-substrate interface of titanium implant. (author).

21691 (INIS-JP–029, pp. 150-151) **Trace element analysis of soy sauce.** Tomita, Michio (Kyoto Prefectural Univ. (Japan)); Haruyama, Yoichi; Saito, Manabu. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

Trace elements in soy sauce have been measured by means of in-air PIXE. Six kinds of trace elements were detected, such as Mu, Fe, Ni, Zn, Cu and Br. Concentrations of Mn, Fe, Zn and Br which were observed in all samples, have been determined. Each analyzed sample contained considerable amount of bromine about 160 ppm. (author).

21692 (INP–1648/CA) **Instrumental methods for analysis of some elements in flour.** Zagrodzki, P. (Uniwersytet Jagiellonski, Cracow (Poland)); Dutkiewicz, E.M.; Malec, P.; Krosniak, M.; Knap, W.; Bichonski, A. Institute of Nuclear Physics, Cracow (Poland). Oct 1993. 14p. Order Number DE95632164. Source: OSTI; NTIS; INIS.

For ten various brands of flour contents of chosen (heavy) elements were determined by means of ICP, GF-AAS, PIXE and ASV/CSV methods. General performance of participating laboratories as well as pros and cons of different analytical methods were compared and discussed. (author). 6 refs, 6 figs, 7 tabs.

21693 (LA-SUB–94-37) **Ultraviolet-visible-near infrared spectra of 50 samples.** Taylor, B. (Crane Unidynamics Phoenix, AZ (United States)). Los Alamos National Lab., NM (United States); Crane Unidynamics Phoenix, AZ (United States). 30 Aug 1988. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011062. Source: OSTI; NTIS; GPO Dep.

Under the subject contract, Unidynamics/Phoenix recorded the ultraviolet-visible-near infrared spectra of 50 samples supplied by LANL. A Varian Cary 2300 series spectrophotometer produced the spectral data. The spectrophotometer was interfaced to a Varian D5-15 Data Station, and hard copies of data were made. Baseline corrections throughout the wavelength range were established using Halon as a reference material. Corrected measurements were automatically made by the system on every sample. Two types of sample holders were tried. Before collecting data on the LANL samples, identical samples of PETN were examined using both holders.

21694 (NREL/CP–433-7748) **Applications of free-jet, molecular beam, mass spectrometric sampling: Proceedings.** Milne, T. (ed.). National Renewable Energy Lab., Golden, CO (United States). Mar 1995. 305p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-9410343–: Applications of free-jet, molecular beam, mass spectrometric sampling conference, Estes Park, CO (United States), 11-14 Oct 1994). Order Number DE95004052. Source: OSTI; NTIS; GPO Dep.

Over the past 35 years, the study of die behavior and uses of free-jet expansions for laboratory experiments has greatly expanded and matured. Not the least of these uses of free-jet expansions, is that of extractive sampling from high temperature, reactive systems. The conversion of the free-jet expanded gases to molecular flow for direct introduction into the ion source of a mass spectrometer offers several advantages, to be illustrated in these pages. Two meetings on this subject were held in 1965 and 1972 in Missouri, sponsored by the Office of Naval Research and Midwest Research Institute. At these meetings rarefied gas dynamicists came together with scientists using free-jet sampling for analytical purposes. After much too long a time, this workshop was convened to bring together modern practitioners of FJMBS (Free-jet, Molecular-beam, mass spectrometry) and long time students of the free-jet process itself, to assess the current state of the art and to forge a community that can foster the development of this novel analytical approach. This proceedings is comprised of 38 individually submitted papers. Individual papers are indexed separately on the Energy Data Base.

21695 (SAND–94-3162C) **The detection of mixtures of NO_x's with hydrogen using catalytic metal films on the Sandia Robust Sensor with pattern recognition.** Hughes, R.C.; Osbourn, G.C.; Bartholomew, J.W.; Rodriguez, J.L. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950650–4: 8. international conference on solid-state sensors and actuators and 9th biannual international conference and annual European conference on solid-state sensors, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95013865. Source: OSTI; NTIS; GPO Dep.

Microsensors often do not have the selectivity to chemical species available in large laboratory instruments. A new type of pattern recognition algorithm is used to classify mixtures of H_2 with NO_2 and O_2. The microsensors used are thin film catalytic metal field effect transistors and chemiresistors on the Sandia Robust Sensor platform. For this study pure Pd thin films and Pd/Ni alloys are shown to provide good classification of mixtures containing NO_2 from those containing O_2 or no oxidant.

21696 (UCRL-ID–119315) **A preliminary study of extraction solvents for CW-agents and their decomposition products [3:1 (methylene chloride:isopropanol) vs. methylene chloride].** Alcaraz, A.; Ward, R.L.; Hulsey, S.S.; Andresen, B.D. Lawrence Livermore National Lab., CA (United States). 15 Sep 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012108. Source: OSTI; NTIS; GPO Dep.

The major focus of this study was to explore the possibility of using different extraction solvents (or solvent combinations) to isolate CW agents and their degradation products from environmental and industrial samples. The general approach for extracting, e.g. water samples, required the use of a 3:1 (methylene chloride:isopropanol) extraction solvent. Although the 3:1 solvent extraction work-up methods provided excellent results in several Inter-laboratory Comparison Tests, the implementation of these methods for CW on-site analysis exercises was difficult (the methods require cumbersome equipment and are labor intensive). However, due to the time, power, and size restraints set forth by the Chemical Warfare Convention (CWC) for a CW on-site inspection, LLNL developed new sample work-up methods. The approach selected by LLNL incorporated solid phase extraction (SPE) techniques. It is evident from this preliminary study that new or previously used extraction solvents should be re-investigated. It was determined that care must be taken in handling the samples prior to NMR measurements. Also, it was determined that the four target compounds used in this study were extracted on average 18% higher with 3:1 (CH_2Cl_2:IPA) vs. CH_2Cl_2. However, additional target compounds need to be investigated using this extraction solvent to determine which classes of compounds are better extracted by the use of a 3:1 solvent system. This preliminary study clearly reveals that a mixed solvent system can yield better extraction efficiencies for mixture of compounds in aqueous samples.

21697 (UCRL-ID–120019) **Research on computed tomography reconstructions from one or two radiographs: A report and the application to FXR radiography.** Back, N.; Schneberk, D.; McMillan, C.; Azevedo, S.; Gorvad, M. Lawrence Livermore National Lab., CA (United States). 26 Jan 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013292. Source: OSTI; NTIS; GPO Dep.

This report documents some cooperative research into volumetric image reconstruction from single radiographs. Imaging dynamic events is the most important application for this type of work, but the techniques have possible extensions. Two general objectives guide this work. The first objective is to gain an understanding of the assumptions and limitations of single-view methods for representing internal features. Second, we endeavor to obtain and/or develop techniques for performing image reconstructions with FXR radiographs. If possible, we seek to obtain some quantitative measure of the accuracy of this class of image reconstructions in two respects: (i) in terms of the dimensional accuracy of feature boundaries, and (ii) as pertains to the accuracy of the voxel intensities. Dynamic events are not always self-calibrating, and it is important to establish the reconstruction accuracy of single-view methods for placing bounds on the kinds of conclusions which can be advanced from single-view reconstructed images. Computed tomographic image reconstructions provide dimensional detail of internal structures of objects and provide a measure of the per-voxel attenuation of material in the object. When assumptions behind a reconstruction algorithm are not satisfied, or are satisfied in a limited way, the accuracy of the reconstructed image is compromised. It is the goal of Cr analysis to discern the "real" features of the internals of an object in the midst of a certain level of artifactual content in the image. By understanding the ways in which CT reconstructions from a single radiograph can produce misleading results we hope to develop some measure of the benefits and limitations of single view techniques. 31 refs., 20 figs.

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Refer also to citation(s) 20546, 21101, 21103, 21104, 21105, 21718, 22121, 22126

21698 (ANL/CHM/CP–83703) **Theoretical dynamical studies of metal clusters and cluster-ligand systems.** Jellinek, J. Argonne National Lab., IL (United States). [1995]. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9409347–1: NATO Advanced Study Institute on metal-ligand interactions: structure and reactivity, Cetraro (Italy), 4-16 Sep 1994). Order Number DE95012461. Source: OSTI; NTIS; GPO Dep.

In what follows we use the term cluster to designate a cohesive group of like atoms (molecules), i.e., bare ("neet" "naked") clusters. More generally, the term is also used for organo- and inorganometallic compounds, i.e., ligated clusters. Although the approaches and techniques used by the various disciplines to study metal-ligand interactions are quite different, many of the central subjects and issues are common for them. The common subjects include possible geometric structures and isomeric forms, structural (isomerization) transitions, stability, fluxionality, structure-reactivity correlation (or lack of it), role of coordination, etc. However, the precise interpretation of these issues and the details emphasized by the different disciplines are dictated by the nature of the objects studied and may not, therefore, be identical. For example, questions regarding structures, isomerization transitions, fluxionality or even melting of metal clusters refer to the state and properties of the metal network itself. The same questions, when asked in connection with organo- and inorganometallic compounds, often refer to the arrangements and rearrangements of the ligands attached to a metal framework of a fixed structure. Of course, when required, the state of and changes in the metal framework are considered as well. The fields of metal-containing molecular compounds, surface science, and physics and chemistry of clusters furnish complementary information on a broad variety of metal-ligand systems. A comprehensive understanding of the nature and properties of these systems, as defined by the type and number of metal atoms and ligands involved, can be achieved only through a mutual awareness of and continuing progress in all of these research areas.

21699 (ANL/CMT/CP–85232) **Computational studies of Bronsted acid sites in zeolites.** Curtiss, L.A. (Argonne National Lab., IL (United States)); Iton, L.E.; Zygmunt, S.A. Argonne National Lab., IL (United States). Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950439–14: SMS simulation multiconference: simulation as a critical technology, Phoenix, AZ (United States), 9-13 Apr 1995). Order Number DE95013391. Source: OSTI; NTIS; GPO Dep.

The authors have performed high-level ab initio calculations using both Hartree-Fock (HF) and Moller-Plesset perturbation theory (MP2) to study the geometry and energetics of the adsorption complex involving H_2O and the Bronsted acid site in the zeolite H-ZSM-5. In these calculations, which use aluminosilicate cluster models for the zeolite framework with as many a 28 T atoms (T = Si, Al), we included geometry optimization in the local vicinity of the acid site at the HF/6-31G(d) level of theory, and have calculated corrections for zero-point energies, extensions for zero-point energies, extensions to higher basis sets, and the influence of electron correlation. Results for the adsorption energy and geometry of this complex are reported and compared with previous theoretical and experimental values.

21700 (DOE/BC/14882–10) **Responsive copolymers for enhanced petroleum recovery. Second annual report.** McCormick, C.; Hester, R. University of Southern Mississippi, Hattiesburg, MS (United States). Dept. of Polymer Science. May 1995. 200p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14882. Order Number DE95000143. Source: OSTI; NTIS; GPO Dep.

The authors describe second year efforts in synthesis, characterization, and rheology to develop polymers with significantly improved efficiency in mobility control and conformance. These advanced polymer systems would maintain high viscosities or behave as virtual gels under low shear conditions and at elevated electrolyte concentrations. At high fluid shear rates, associates would deaggregate yielding low viscosity solutions, reducing problems of shear degradation or face plugging during injection. Polymeric surfactants were also developed with potential for use in higher salt, higher temperature reservoirs for mobilization of entrapped oil. Chapters include: Ampholytic terpolymers of acrylamide with sodium 3-acrylamido-3-methylbutanoate and 2-acrylamido-2-methylpropanetrimethylammonium chloride; Hydrophilic sulfobetaine copolymers of acrylamide and 3-(2-acrylamido-methylpropane-dimethylammonio)-1-propanesulfonate; Copolymerization of maleic anhydride and N-vinylformamide; Reactivity ratio of N-vinylformamide with acrylamide, sodium acrylate, and n-butyl acrylate; Effect of the distribution of the hydrophobic cationic monomer dimethyldodecyl(2-acrylamidoethyl)ammonium bromide on the solution behavior of associating acrylamide copolymers; Effect of surfactants on the solution properties of amphipathic copolymers of acrylamide and N,N-dimethyl-N-dodecyl-N-(2-acrylamidoethyl)ammonium bromide; Associative interactions and photophysical behavior of amphiphilic terpolymers prepared by modification of maleic anhydride/ethyl vinyl ether copolymers; Copolymer compositions of high-molecular-weight functional acrylamido water-soluble polymers using direct-polarization magic-angle spinning ^{13}C NMR; Use of factorial experimental design in static and dynamic light scattering characterization of water soluble polymers; and Porous medium elongational rheometer studies of NaAMB/AM copolymer solutions.

21701 (DOE/ER/13183–10) **Thermodynamic and kinetic aspects of surface acidity. Progress report, July 1, 1994–June 30, 1995.** Dumesic, J.A. Wisconsin Univ., Madison, WI (United States). Dept. of Chemical Engineering. [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13183. Order Number DE95012902. Source: OSTI; NTIS; GPO Dep.

Catalytic cracking of isobutane and 2-methyl-hexane over various USY-zeolite catalysts was studied. A kinetic model was developed for isobutane cracking over calcined and steamed Y-zeolite catalysts. Catalyst steaming leads to decreased Bronsted acidity. The studies of catalyst acid and basic properties were broadened to include alumina-supported metal oxides and a sulfated zirconia catalyst (isomerization of normal butane).

21702 (DOE/ER/13460–1) **Energies of organic compounds.** Wiberg, K.B. Yale Univ., New Haven, CT (United States). Dept. of Chemistry. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13460. Order Number DE95014701. Source: OSTI; NTIS; GPO Dep.

The studies included hydrolysis of ketals, hydration of alkenes, barrier to rotation about C-O bonds in esters and acids, hydrolysis of lactones, reduction of ketones, non-bonded interactions, and enthalpies of vaporization of ketones, ketals, and other compounds.

21703 (DOE/ER/13460–3) **[Energies of organic compounds].** Yale Univ., New Haven, CT (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13460. Order Number DE95014703. Source: OSTI; NTIS; GPO Dep.

The first part of our study of the enthalpy of reduction of carbonyl compounds has been completed and includes four aldehydes, acetone, a series of cyclic ketones and ethyl acetate. Results suggest that some of the literature data for these compounds are significantly in error. Equilibrium constants have been measured for the reaction of carbonyl compounds with water to give hydrates as well as with methanol to give either hemiacetals or acetals. They cover a wide range, and studies are underway to determine the reasons for the differences. Studies of the enthalpies of hydration of some alkenes which yield tertiary alcohols have been completed, as well as a study of the hydrolysis of lactones. The "gauche effect" has been studied, and has been shown to result from the formation of bent bonds when atoms of much different electronegativity are joined.

21704 (DOE/ER/13460–6) **[Energies of organic compounds].** Wiberg, K.B. Yale Univ., New Haven, CT (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13460. Order Number DE95014704. Source: OSTI; NTIS; GPO Dep.

The enthalpy of reduction of lactones to the corresponding diols has been determined, allowing the enthalpies of formation of the lactones to be determined. Results of this study agree well with data obtained for enthalpies of hydrolysis of the lactones. We have begun the measurement of the enthalpies of reduction of norbornanones, and we have shown that it is possible to determine the difference in energy between the exo and endo forms of the product alcohols by measuring the equilibrium constant as a function of temperature. The study of the enthalpies of hydration of carbonyl compounds has continued, and the enthalpies of hydrolysis of the corresponding ketals is being determined. The study of the enthalpies of hydration of alkenes is nearly completed, and the rearrangement reactions which were uncovered are being investigated.

21705 (DOE/PC/91030–T13) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 13, October–December 1994.** Dow Corning Corp., Carrollton, KY (United States). Feb 1995. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014334. Source: OSTI; NTIS; GPO Dep.

The purpose of this contract is to develop a process for converting light alkane gases to methyl chloride via oxyhydrochlorination using highly selective, stable catalysts in fixed-bed reactors designed to remove the large amount of heat generated, so as to control the reaction temperature. Further, the objective is to obtain the engineering data base necessary for developing a commercially feasible process and to evaluate t economics of the process. Significant progress was made in six different technical areas during this quarter. These key highlights are: (1) Evaluation of catalyst samples from UCI led to the ordering of the OHC PDU catalyst batch. This catalyst batch arrived, was screened and found to be defective, and was reordered. (2) Natural gas containing higher hydrocarbons was used as a methane source. The reactant mixture formed oxygenates at temperatures lower than observed in the past. Burning at such low temperatures seems to create a product stream containing very little CH_2Cl_2. (3) Although it has not been decided if the PDU will use natural gas from the plant or methane or natural gas from cylinders as a methane feed source, it was concluded that an adsorption unit to remove sulfur and higher hydrocarbons is not necessary at this time. (4) PDU construction was completed in December. The bulk of insulation work was completed at the end of November. Much effort has been put into pressure testing the PDU's systems. The startup team has become adept at finding and correcting such leaks. (5) SOP writing for the PDU was completed this quarter with communication with the software programmer to insure agreement between the software and SOP.

21706 (DOE/PC/91030–T14) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 9, October 1993–December 1993.** Dow Corning Corp., Carrollton, KY (United States). Feb 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014333. Source: OSTI; NTIS; GPO Dep.

The purpose of this contract is to develop a process for converting light alkane gases to methyl chloride via oxyhydrochlorination using highly selective, stable catalysts in fixed-bed reactors designed to remove the large amount of heat generated, so as to control the reaction temperature. Further, the objective is to obtain the engineering data base necessary for developing a commercially feasible process and to evaluate the economics of the process. The key technical progress this quarter was the great deal of progress in equipment design, instrument selection and

data sheet preparation for the PDU. This work is outlined under the Task 2.0 and 3.0 sections below. Catalyst definition this quarter provided limited progress due to the attempt to start up a new screening reactor than ran at higher pressures. The use of high pressure without the availability of a HCl removal unit operation resulted in many experimental problems. This will be solved by the use of the separation unit operation lab equipment as a catalyst screening reactor in the future. Work continued on the development of the separation system. Results showed that at a given pressure and L/G , as the amount of methyl chloride in the feed gas increases, the removal efficiency also increases. Variation of column parameters showed that the "absorber" acts not only as an absorber, but also as a direct contact condenser. This will provide significant benefit to the PDU.

21707 (ETDE-DE–123) **Electrochemical investigation of the inclusion/removal of oxygen in/from tin dioxide at high temperatures.** Kaczorowski, H.; Pohl, J.P. Dortmund Univ. (Germany). Lehrstuhl fuer Physikalische Chemie 1. [1993]. 11p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0328736A. Order Number DE95780302. Source: OSTI; NTIS (US Sales Only).

This work is a report on investigations on the dependence of nonstochiometry of tin dioxide, ie the deviation from the tin/oxygen ratio of 1:2 as a function of the chemical potential $\mu_0(SnO_2)$ of oxygen in SnO_2. The μ_0 (SnO_2) in the tin dioxide measurement electrode was determined of potentio-statically fixed via the EMF of the solid chain with the build-up Cu, Cu_2O vertical stroke $ZrO_2(Y_2O_3)$ vertical stroke SnO_2 vertical stroke Au. During current flow through the chain, oxygen is included in /removed from the oxide in the firm of oxygen ions and electrons. With the aid of measured results on the electron concentration of SnO_2, socalled 'electrochemical titration' of tin oxide was obtained from these measurements at various temperatures, in which the relationship between (absolute) nonstochiometry and partial oxygen pressure was reproduced. By evaluation of the kinetics of the above-mentioned inclusion/removal process, the chemical diffusion coefficient of oxygen in tin dioxide was able to be determined. (MM)

21708 (JINR–94-1, pp. 22-23) **Experimental studies for production of some medically important radionuclides: ruthenium-97, tungsten-178, actinium-225.** Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Norseev, V.A.; Stregailov, V.I.; Tsupko-Sitnikov, V.V.; Zaizeva, N.G.; Peretruchin, V.F.; Korsunskij, V.N.; Marchenkov, N.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 2 figs. ACTINIUM 225/isotope production; RUTHENIUM 97/isotope production; TUNGSTEN 178/isotope production; ALPHA SOURCES; ENERGY SPECTRA; MEV RANGE 10-100; PROTON REACTIONS; TANTALUM 181 TARGET; TECHNETIUM 99 TARGET

21709 (KAPL–4790) **Solubility behavior of quartz and corundum in supercritical water: A quantitative thermodynamic interpretation.** Ziemniak, S.E. Knolls Atomic Power Lab., Schenectady, NY (United States). May 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. Order Number DE95012294. Source: OSTI; NTIS; INIS; GPO Dep.

Dissolution reaction equilibria for α-quartz (SiO_2) and corundum (α-Al_2O_3) in pure, supercritical water are quantified using a density-dependent thermodynamic model. The database of existing solubility literature for α-quartz (0.2-10 kb, 200–575°C) is shown to be consistent with the presence of two hydrolyzed SI(IV) ion forms: $Si(OH)_4(aq)$ and $Si_2O(OH)_6(aq)$; the corundum database (1-20 kb, 400–700°C) is consistent with $Al(OH)_3(aq)$ and $Al(OH)_4^-$. A third Si(IV) ion hydroxocomplex, $Si_2O_2(OH)_5^-$, is indicated at lower pressures (0.03-0.10 kb). The characteristic sigmoidal nature of the solubility isobars is explained by dimerization of $Si(OH)_4(aq)$ (at high densities) or the formation of anionic hydrolysis products, $Si_2O_2(OH)_5^-$ and $Al(OH)_4^-$, in the low density region ($p < 0.01$ gm/cc). By means of the evaluated equilibria, thermochemical properties of $Si_2O(OH)_6(aq)$ and $Si_2O_2(OH)_5^-$ are made available for the first time.

21710 (LBL–36640) **Energy states and energy flow near the transition states of unimolecular reactions.** Moore, C.B. (Univ. of California, Berkeley, CA (United States). Dept. of Chemistry). Lawrence Berkeley Lab., CA (United States). Oct 1994. 19p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant CHE8816552; CHE9316640. (CONF-9410349–1: 38. conference on chemical research, chemical dynamics of transient species, Houston, TX (United States), 24-25 Oct 1994). Order Number DE95012385. Source: OSTI; NTIS; GPO Dep.

The use of lasers with jet-cooled samples has improved energy and angular momentum resolution for the reactant and time resolution for the rate constant by orders of magnitude. The resolution of product quantum states has added a new dimension to unimolecular dynamics. In the past, the geometry, barrier height and vibrational frequencies of the transition state in RRKM theory were adjusted to fit thermal unimolecular reaction rate data. There have been successful quantitative tests of the ability of ab initio theory to calculate transition state geometries accurately and barrier heights to a few kJ/mol for simple molecules. Predicted frequencies tend to be somewhat too high for the softest modes which are of most importance in determining rates; however, the basic normal modes and sequence of frequencies seem to be correctly predicted. RRKM theory can be used with ab initio results to predict rate constants to within a factor of two or three and may be used for quantitative extrapolation to conditions not accessible in the laboratory but important in practical situations. Experiments on single molecular eigenstates have revealed quantum statistical fluctuations in rates which are predicted quantitatively in the appropriate extension of RRKM theory. Many experiments seeking to demonstrate non-statistical or non-RRKM dynamics have demonstrated the very wide range of applicability of the RRKM model. A few such experiments have demonstrated a lack of complete vibrational energy randomization in a reactant molecule. Dynamical theory has provided an exact quantum analog to RRKM theory which will combine with future experiments to define the extent to which quantized motion along the reaction coordinate and coupling between the reaction coordinate and vibrational degrees of freedom at the transition state are important. 42 refs., 11 figs.

21711 (MAE–303) **A thermodynamical formulation for chemically active multi-phase turbulent flows.** Ahmadi, G.; Cao, J. Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering. Mar 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91297. Order Number DE95015964. Source: OSTI; NTIS; GPO Dep.

A generalized thermodynamics for chemically active multiphase solid-fluid mixtures in turbulent state of motion is formulated. The global equations of balance for each phase are ensemble averaged and the local conservation laws for the mean motions are derived. The averaged and the local conservation laws for the mean motions are derived. The averaged form of the Clausius-Duhem inequality is used and the thermodynamics of the chemically active mixtures in turbulent motion is studied. Particular attention is given to the species concentration and chemical reaction effects, in addition to transport and interaction of the phasic fluctuation energies. Based on the averaged entropy inequality, constitutive equations for the stresses, energy, heat and mass fluxes of various species are developed. The explicit governing equations of motion are derived and discussed.

21712 (NEDO-IT–9209) **Investigation on cluster science.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 201p. (In Japanese). Order Number DE95786809. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

Investigation and report were made on characteristics of dynamic clusters, their stabilization method, characteristics of stabilized clusters, etc. In the experimental elucidation of characteristics of

gas phase dynamic clusters, reported are anion polymerization inside metal clusters, alloy clusters and acrylonitrile clusters, cluster formation by hydrogen bond among water molecules, carbon clusters and fullerene, etc. In theoretical elucidation, reported are studies on molecular dynamics relating to water cluster, the electronic state of fullerene, etc. As to characteristics of solid dynamic clusters, reported are carbon nanotube, silver clusters in silver salt photosensitive materials, etc. With relation to the stabilized method of clusters and characteristics of stabilized clusters, reported are synthesis of cluster using zeolite lattice space, light and magnetic characteristics of alkaline metal clusters, catalytic action of molecular metal clusters, etc. 328 refs., 119 figs., 10 tabs.

21713 (NEDO-IT–9320) **Investigation on cluster science.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 189p. (In Japanese). Order Number DE95786808. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

Investigation was made on cluster science to establish a new material science and develop basic technology for material development, etc. Clusters are an intermediate species existing between solid or liquid and individual atoms/molecules. A small number of atoms/molecules are connected by weak interaction and become a structure unit of material, showing interesting stratous physical properties. The cluster-system photovoltaic reaction secretly keeps a possibility of spectroscopically detecting the reaction transition state, and expansion of methodology to the general system is anticipated. Internal motion of clusters is nonlinear, and its dynamics has a possibility of elucidating fluctuations and reaction around the equilibrium structure and essence of physical property manifestation. If taking clusters as new reaction intermediates/reaction field, it will be possible to synthesize clusters aiming at reaction control and chemically design new substances. It is thought that clusters are not only an object for study as minority many-body system but also what provides useful means of reaction/physical property control. 219 refs., 118 figs., 6 tabs.

21714 (PNL-SA–25493) **A high yield reverse micelle synthesis of catalysts and catalyst precursors.** Linehan, J.C.; Matson, D.W.; Darab, J.G.; Fulton, J.L. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504141–2: Advanced techniques in catalyst preparations syposium, Anaheim, CA (United States), 2-7 Apr 1995). Order Number DE95010723. Source: OSTI; NTIS; GPO Dep.

Reverse micelles or water-in-oil microemulsions have been prepared using a mixed AOT/SDS surfactant to increase the stability of the microemulsion and thereby allow a high loading of particle-forming precursors in the aqueous cores. The Modified Reverse Micelles (MRM), as these new binary surfactant microemulsions are called, have proven useful for the laboratory-scale synthesis of nanoscale metals, metal oxides, metal sulfides, and mixed metal materials. The system allows control over the phase and size of the precipitated crystallites and is ideal for producing nanocrystalline powders and suspensions.

21715 (RISO-R–818(EN)) **A study of cooperative effects in polyfunctional molecules.** Lund Joergensen, B. Risoe National Lab., Roskilde (Denmark). Environmental Science and Technology Dept.; Roskilde Universitetscenter (Denmark). Mar 1995. 57p. Order Number DE95787743. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

On the basis of the development in the area of polyfunctional molecules, the effect of having functional groups close together, is investigated. At first the traditional description of polymers such as polyelectrolytes and polyacids are presented. A group of simple benzoic acid derivatives with a varying number of carboxylic acid groups are used as model systems. Titrations on mellitic acid are performed with varying ionic strength. The thermodynamic properties of ionization of polycarboxylic acids are described from literature data. As the picture of the behaviour of the acids are very complex, the effects are separated in internal and external contributions. The internal effect are found from semi-empirical calculations performed with the PC-program HyperChem™. The heat of formation in vacuum are found from the optimized structures, which are calculated with the PM3 method, and this gives an expression for the internal effects in the molecule. The knowledge achieved about the internal effects in polyfunctional molecules can contribute to the understanding of their behaviour. The surroundings are still of vital significance, so a simple method for prediction of the behaviour in a variety of surroundings can not be achieved. (au) 11 tabs., 23 ills., 96 refs.

21716 (SAND–95-0932C) **Characterization of microenvironment polarity and solvent accessibility of polysilsesquioxane xerogels by the fluorescent probe technique.** Shea, K.J. (Univ., of California, Irvine, CA (United States). Dept. of Chemistry); Zhu, H.D.; Loy, D.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950297–1: American Chemical Society spring meeting, Anaheim, CA (United States), 2 Feb 1995). Order Number DE95011874. Source: OSTI; NTIS; GPO Dep.

Poly (1, 4 bis(triethoxysilyl)benzene) (PTESB), a representative of a new type of organic-inorganic hybrid polysilsesquioxane material, was characterized by fluorescence spectroscopy for both microenvironmental polarity and solvent accessibility. A dansyl fluorescent molecule was incorporated into the bulk as well as onto the surface of both PTESB and silica materials. Information about the microenvironment polarity and accessibility of PTESB to various organic solvents was determined and compared to that of silica gel. This study found that both the bulk and surface of PTESB are less polar than that of the silica material. The silica material is accessible to polar solvents and water, while YMB is accessible to polar solvents but not to water. The hydrophobicity of PTESB differentiates these new materials from silica gel.

4004 Electrochemistry

Refer also to citation(s) 20801, 20969, 21333, 21707

4005 Photochemistry

Refer also to citation(s) 21638

4006 Radiation Chemistry

Refer also to citation(s) 20855

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 20790, 21678

21717 (FEI–2393) **Problems of synthesis and generating properties of uranium containing inorganic liquid on the basis of phosphorus oxychloride activated with neodymium.** Dobrovol'skij, A.F.; D'yachenko, P.P.; Seregina, E.A.; Tikhonov, G.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 10p. (In Russian). Order Number DE95633015. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper the results of research of uranium containing lasants on the basis of phosphorus oxychloride made in accordance with our technology are presented. It is shown that U(IV)-impurities in these lasants are absent. The inactive loss coefficient of the uranium containing lasant at λ=1050 nm coincides with the inactive loss coefficient of standard inorganic liquid lasant without uranium. The research of the amplitude and the shape of generation impulses in dependence upon pumping energy and the spectral structure of flashlamp pumping are performed. 2 refs.; 5 figs.

21718 (FEI–2394) **Consideration of the application of D_2O:Eu^{3+}:UO_2^{2+} liquid as an active medium for nuclear pumped lasers.** D'yachenko, P.P.; Kalinin, V.V.; Seregina, E.A.; Seregin, A.A.; Tikhonov, G.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 11p. (In Russian). Order Number DE95633016. Source: OSTI; NTIS (US Sales Only); INIS.

The efficiency of charged particles energy conversion to luminescence energy, lifetime of excited level, position and width of spectral lines of Eu^{3+} ions during excitation of media with nuclear reaction products have been measured for $D_2O:Eu^{3+}:UO_2^{2+}$. The research was performed by the use of the neutron generator KG-0.3 IPPE. It was found out that during nuclear pumping the lifetime of the level $^5D_0$ of Eu^{3+}-ions depended very slightly on the UO_2^{2+}-concentration however during optical pumping the lifetime was inversely proportional to $C_{UO_{22+}}$. In the paper the estimate of several parameters for NPL based on liquid $D_2O:Eu^{3+}:UO_2^{2+}$ is submitted. 7 refs.; 3 figs.; 2 tabs.

21719 (FEI–2395) **Subthreshold diagnostics and features of uranium-containing laser-active liquid on the basis of sulfuryl.** Dobrovol'skij, A.F.; D'yachenko, P.P.; Kalinin, V.V.; Seregina, E.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 13p. (In Russian). Order Number DE95633017. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the subthreshold diagnostic of new uranium containing lasants on the basis of sulfuryl are presented. The research was performed on KG-0.3 IPPE accelerator. The charged particle pumping efficiency of neodymium ions in sulfuryl is slightly less than phosphorus oxychloride. The generation properties of Nd^{3+} ions into sulfuryl with and without uranyl are investigated by flash-lamp pumping. It has been found that the photoreduction of uranyl in this medium is reversible. 11 refs.; 5 figs.; 1 tab.

21720 (WHC-SA–2855) **Studies of the chemistry of transuranium elements and technetium at the Institute of Physical Chemistry, Russian Academy of Sciences, supported by the US Department of Energy.** Peretrukhin, V.F. (Russian Academy of Sciences, Moscow (Russian Federation). Inst. of Physical Chemistry); Delegard, C.H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950917–10: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95011570. Source: OSTI; NTIS; INIS; GPO Dep.

Studies at Hanford in the 1980s revealed the potential for actinides to form stable soluble complexes in alkaline media, simulating radioactive tank waste. Pu(IV) hydrous oxide and Pu(VI) solubility increased with hydroxide concentration, ionic strength, and aluminate/carbonate concentrations. Subsequent contacts between US and Russian researchers in 1993 led to a technical literature review of the chemistry of TRU and Tc in alkaline media; this review addresses oxidation states, solubility, speciation, redox reactions, electrochemistry, radiation chemistry, and separations in alkaline media. As an outgrowth, a program of fundamental and applied chemistry studies of TRU and Tc is being conducted at IPC/RAS with US DOE support: solubility, redox reagents, coprecipitation, and radiation chemistry. This overview provides information on the Hanford Site tank waste system, US DOE technological needs, and IPC/RAS developments.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 21524, 21592, 21694, 21826, 22130, 22913

21721 (LUTFD2-TFCP–1003) **On modeling of unsteady combustion utilizing continuum mechanical mixture theories and large eddy simulations.** Fureby, C. Lund Univ. (Sweden). Dept. of Combustion Physics. Apr 1995. 82p. Order Number DE95779293. Source: OSTI; NTIS.

This thesis considers the development of a consistent set of Large Eddy Simulation (LES) models for unsteady combustion. The theoretical background for the simulation models is modern continuum mechanical mixture theories, which provide the necessary framework for a hierarchical structure of theoretical models. Furthermore, this theoretical framework includes multi-temperature mixtures as well as multi-phase flows. Instead of increasing the capability of the theoretical model to encompass such processes, the theoretical model contains these elements from the beginning. Consequently, the model can systematically be reduced to give models for a large number of processes or systems. This is more attractive compared to the traditional approach, due to the generality and the high degree of adaptability. Since the aim is to study unsteady combustion processes, a simulation model having high spatial and temporal resolution is needed. Due to the well known resolution problem, some degree of phenomenology must inevitably be included in the physical model to replace some processes occurring at a microscopic level. This leads us to the Large Eddy Simulation methodology. A LES model has therefore been developed to encompass the theoretical model above. The LES model is cast into a numerical simulation model by a finite volume discretization and high-order interpolation approximations for the fluxes. In order to investigate the predictive capabilities of this LES model, numerical simulations have been performed on several configurations corresponding to test rigs or objects for which experimental data is available. Comparison indicate that, in all cases investigated, the LES model gives reliably predictions. 187 refs, 4 figs

21722 (NILU-OR–20/94, pp. 19-22) **Optical analysis of SO_2 and NO_2 in the products of fuel combustion.** Ignatavicius, M. (Vilnius Univ., Vilnius (Lithuania)); Kazakevicius, E.; Orshewski, H. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper presents the measured results of the absorption spectra of SO_2, NO, and NO_2 in UV and visible regions. The authors have used the differential absorption technique based on the difference at molecular absorption cross sections in the maximum and minimum of absorption and thus enabling the measurement of air pollutant concentrations. They have employed 2 m path length cell and Xenon flash-lamp as the light source for the investigation of gases in the laboratory. The same measurements were carried out in the enterprise "Thermal plant of Alytus". The absorption cross sections of NO_2 and SO_2 have rather strong temperature dependence. It was possible to determine presence of SO_2 and NO_2 because of a general electronic absorption. As a result of these investigations, a unit for the measurement of sulphur and nitrogen dioxides was designed. The calibration of the unit was performed using "Testoterm" equipment as a reference. 6 figs.

21723 (SAND–95-8508J) **Thermal-grating contributions to degenerate four-wave mixing in nitric oxide.** Danehy, P.M. (Stanford Univ., Stanford, CA (United States). High Temperature Gasdynamics Laboratory); Paul, P.H.; Farrow, R.L. Sandia National Labs., Livermore, CA (United States). [1995]. 34p. Sponsored by USDOE, Washington, DC (United States);Department of the Air Force, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010914. Source: OSTI; NTIS; GPO Dep.

We report investigations of degenerate four-wave mixing (DFWM) line intensities in the $A^2\Sigma^+ \leftarrow X^2\Pi$ electronic transitions of NO. Contributions from population gratings (spatial perturbations in the level populations of absorbing species), and thermal gratings (spatial perturbations in the overall density) were distinguished and compared using several experimental and analytical techniques. For small quantities of NO in a strongly quenching buffer gas (CO_2), we found that thermal-grating contributions dominated at room temperature for gas pressures of ~0.5 atm and higher. In a nearly non-quenching buffer (N_2) the population-grating mechanism dominated at pressures of ≈1.0 atm and lower. At higher temperatures in an atmospheric-pressure methane/air flame, population gratings of NO were also found to dominate. We propose a simple model for the ratio of thermal- to population-grating scattering intensities that varies as P_4T^{-4-4}. Preliminary investigations of the temperature dependence and detailed studies of the pressure dependence are in agreement with this model. Measurements of the temporal evolution and peak intensity of isolated thermal-grating signals are in detailed agreement with calculations based on a linearized hydrodynamic model.

21724 (UCRL-JC–120938) **A modelling study of the combustion of n-heptane and iso-octane in a high pressure**

turbulent flow reactor. Curran, H.J. (Lawrence Livermore National Lab., CA (United States)); Gaffuri, P.; Pitz, W.J.; Westbrook, C.K.; Callahan, C.; Dryer, F.L.; Held, T. Lawrence Livermore National Lab., CA (United States). 13 Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504163–3: Combustion Institute and American Flame Research onference, San Antonio, TX (United States), 23-26 Apr 1995). Order Number DE95013440. Source: OSTI; NTIS; GPO Dep.

The primary reference fuels n-heptane and iso-octane and their mixtures are used as a measure of the tendency of a given automotive fuel to cause knocking or pre-ignition in an internal combustion engine. Consequently, many experimental studies have been performed on these hydrocarbons in an attempt to better understand their oxidation. Shock tube studies at high temperature and pressure have been performed. Low temperature studies, in which species concentration profiles of primary, intermediate and final products, have been carried out using jet stirred flow reactors. In addition, experiments have been performed in CFR engines and fundamental features of n-heptane autoignition have been observed using a rapid compression machine. A detailed chemical kinetic reaction mechanism is employed here to study the oxidation of both fuels. Computed results are compared with experimental data obtained in the High Pressure Turbulent Flow Reactor at Princeton University.

42 ENGINEERING

Refer also to citation(s) 22372, 22931

21725 (ANL/ED/CP–86110) **Photographic as-builts for Argonne National Laboratory-West.** Sherman, E.K.; Wiegand, C.V. Argonne National Lab., Idaho Falls, ID (United States). 19 Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9504158–1: CAD/CAE conference, Atlanta, GA (United States), 19 Apr 1995). Order Number DE95011795. Source: OSTI; NTIS; GPO Dep.

Located 35 miles West of Idaho Falls, Idaho, Argonne National Laboratory-West operates a number of nuclear facilities for the Department of Energy (DOE) through the University of Chicago. Part of the present mission of Argonne National Laboratory-West includes shutdown of the EBR-II Reactor. In order to accomplish this task the Engineering-Drafting Department is exploring cost effective methods of providing as-building services. A new technology of integrating photographic images and AUTOCAD drawing files is considered one of those methods that shows promise.

21726 (SAND–94-2287C) **Mars Pathfinder airbag impact attenuation system.** Waye, D.E. (Sandia National Labs., Albuquerque, NM (United States)); Cole, J.K.; Rivellini, T.P. Sandia National Labs., Albuquerque, NM (United States). [1995]. 11p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950550–3: 13. aerodynamics decelerator systems technology conference, Clearwater, FL (United States), 15-19 May 1995). Order Number DE95009849. Source: OSTI; NTIS; GPO Dep.

The Mars Pathfinder spacecraft, scheduled for launch in November 1996, is designed to validate a low cost Entry, Descent, and Landing system and to perform scientific surface operations. The Jet Propulsion Laboratory and Sandia National Laboratories teamed to design, fabricate, test and validate a prototype 0.38 scale model of an airbag impact attenuation system. A computer code was developed to predict the performance of the airbag system. A test program in Sandia's High Altitude Chamber was performed to validate the code and demonstrate the feasibility of the airbag concept and design. In addition, freefall tests were performed at representative velocities to demonstrate the structural integrity of the airbag system design. The feasibility program demonstrated that the airbag impact attenuation design will protect the lander upon impact with the Martian surface.

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 20780, 20785, 20824, 20837, 20870, 20878, 20943, 20960, 21061, 21062, 21404, 21405, 21411, 21498, 22129, 22954, 22955, 22967

21727 (ANL/IFR/CP–85395) **Proactive maintenance initiatives at Argonne National Laboratory-West.** Duckwitz, N.R.; Duncan, L.W.; Whipple, J.J. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9404269–1: Energy Facility Contractors Group (EFCOG) meeting, Knoxville, TN (United States), 4 Apr 1994 - 6 apr 1995). Order Number DE95012922. Source: OSTI; NTIS; INIS; GPO Dep.

In the late 1980's, ANL-W Management foresaw a need to provide dedicated technical support for maintenance supervisors. Maintenance supervisors were facing increased challenges to ensure all environmental, safety, and waste management regulations were followed in daily maintenance activities. This increased burden was diverting supervisory time away from on-the-job supervision. Supervisors were finding less time for their "mentor" roles to ensure maintenance focused on finding and correcting root causes. Additionally the traditional maintenance organization could not keep up with the explosion in predictive maintenance technologies. As a result, engineers were tasked to provide direct technical support to the maintenance organization. Today the maintenance technical support group consists of two mechanical engineers, two electrical engineers and an I&C engineer. The group provides a readily available, quick response resource for crafts people and their supervisors. They can and frequently do ask the support group for help to determine the root cause and to effect permanent fixes. Crafts and engineers work together informally to make an effective maintenance team. In addition to day-to-day problem solving, the technical support group has established several maintenance improvement programs for the site. This includes vibration analysis of rotating machinery, testing of fuel for emergency diesel generators, improving techniques for testing of high efficiency particulate air (HEPA) filters, and capacity testing of UPS and emergency diesel starting batteries. These programs have increased equipment reliability, reduced conventional routine maintenance, reduced unexpected maintenance, and improved testing accuracy. This paper will discuss the interaction of the technical support group within the maintenance department. Additionally the maintenance improvement programs will be presented along with actual cases encountered, the resolutions and lessons learned.

21728 (ANL/TD/CP–84983) **Accelerator requirements for fast-neutron interrogation of luggage and cargo.** Micklich, B.J.; Fink, C.L.; Yule, T.J. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by Federal Aviation Administration, Washington, DC (United States);Executive Office of the President, Washington, DC (United States). DOE Contract W-31109-ENG-38. Contract DTFA03-03-X-00021; Contract 6-CO-160-00-195. (CONF-950512–93: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011846. Source: OSTI; NTIS; INIS; GPO Dep.

Several different fast-neutron based techniques are being studied for the detection of contraband substances in luggage and cargo containers. The present work discusses the accelerator requirements for fast-neutron transmission spectroscopy (FNTS), pulsed fast-neutron analysis (PFNA), and 14-MeV neutron interrogation. These requirements are based on the results of Monte-Carlo simulations of neutron or gamma detection rates. Accelerator requirements are driven by count-rate considerations, spatial resolution and acceptable uncertainties in elemental compositions. The authors have limited their analyses to luggage inspection with FNTS and to cargo inspection with PFNA or 14-MeV neutron interrogation.

21729 (CIEMAT–759) **Control of a mechanical gripper with a fuzzy controller.** Alberdi, J.; Barcala, J.M.; Gamero, E.; Navarrete, J.J. No corporate text available. 1995. 37p. (In Spanish). Order Number DE95780848. Source: OSTI; NTIS.

A fuzzy logic system is used to control a mechanical gripper. System is based in a NLX230 fuzzy micro controller. Control rules are programmed by a 68020 microprocessor in the micro controller

memory. Stress and its derived are used as feedback signals in the control. This system can adapt its effort to the mechanical resistance of the object between the fingers.

21730 (CONF-9505195–5) **Nuclear data for criticality safety - current issues.** Leal, L.C.; Jordan, W.C.; Wright, R.Q. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nuclear criticality technology and safety project (NCTSP) annual meeting; San Diego, CA (United States); 17 May 1995. Order Number DE95013216. Source: OSTI; NTIS; INIS; GPO Dep.

Traditionally, nuclear data evaluations have been performed in support of the analysis and design of thermal and fast reactors. In general, the neutron spectra characteristic of the thermal and fast systems used for data testing are predominantly in the low- anc high-energy range with a relatively small influence from the intermediate-energy range. In the area of nuclear criticality safety, nuclear systems arising from applications involving fissionable materials outside reactors can lead to situations very different from those most commonly found in reactor analysis and design. These systems are not limited to thermal or fast and may have significant influence from the intermediate energy range. The extension of the range of applicability of the nuclear data evaluation beyond thermal and fast systems is therefore needed to cover problems found in nuclear criticality safety. Before criticality safety calculations are performed, the bias and uncertainties of the codes and cross sections that are used must be determined. The most common sources of uncertainties, in general, are the calculational methodologies and the uncertainties related to the nuclear data, such as the microscopic cross sections, entering into the calculational procedure. The aim here is to focus on the evaluated nuclear data pertaining to applications in nuclear criticality safety.

21731 (DOE/MC/30362–4049) **BOA: Asbestos pipe insulation removal robot system. Phase 1.** Schempf, H.; Bares, J.E. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Robotics Inst. Feb 1995. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AR21-93MC30362. Order Number DE95000095. Source: OSTI; NTIS; GPO Dep.

The project described in this report targets the development of a mechanized system for safe, cost-efficient and automated abatement of asbestos containing materials used as pipe insulation. Based on several key design criteria and site visits, a proof-of-concept prototype robot system, dubbed BOA, was designed and built, which automatically strips the lagging and insulation from the pipes, and encapsulates them under complete vacuum operation. The system can operate on straight runs of piping in horizontal or vertical orientations. Currently we are limited to four-inch diameter piping without obstacles as well as a somewhat laborious emplacement and removal procedure - restrictions to be alleviated through continued development. BOA removed asbestos at a rate of 4-5 ft./h compared to 3 ft./h for manual removal of asbestos with a 3-person crew. The containment and vacuum system on BOA was able to achieve the regulatory requirement for airborne fiber emissions of 0.01 fibers/ccm/8-hr. shift. This program consists of two phases. The first phase was completed and a demonstration was given to a review panel, consisting of DoE headquarters and site representatives as well as commercial abatement industry representatives. Based on the technical and programmatic recommendations drafted, presented and discussed during the review meeting, a new plan for the Phase 11 effort of this project was developed. Phase 11 will consist of a 26-month effort, with an up-front 4-month site-, market-, cost/benefit and regulatory study before the next BOA robot (14 months) is built, and then deployed and demonstrated (3 months) at a DOE site (such as Fernald or Oak Ridge) by the beginning of FY'97.

21732 (HW–8140) **234-5 Building design philosophy.** Work, J.B. Battelle Pacific Northwest Lab., Richland, WA (United States). 26 Nov 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013953. Source: OSTI; NTIS; GPO Dep.

This report presents the building and design philosophy of Building 234-5 at the Hanford site.

21733 (HW–8285) **234-5 Project, Specification Letter 234-9, 235-9, Analytical Control Laboratory.** Curtis, R.E. Hanford Works, Richland, WA (United States). 15 Dec 1947. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013954. Source: OSTI; NTIS; GPO Dep.

This document presents the details of the design of the analytical control laboratory for the 234-5 project at the Hanford site.

21734 (HW–8323) **234-5 Project, specification letter 234-10, 235-10, ventilation.** Work, J.B. Hanford Works, Richland, WA (United States). 17 Dec 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013956. Source: OSTI; NTIS; GPO Dep.

This report presents details about the principles used for the arrangement of the Hanford 234-5 building in regards to the ventilation.

21735 (JAERI-Review–95-001) **Report of the 2nd through 7th conferences of Special Committee on Nuclear Criticality Safety.** Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 194p. (In Japanese). Order Number DE95780588. Source: OSTI; NTIS; INIS.

Special committee on Nuclear Criticality Safety was established as a public committee of Atomic Energy Society of Japan in November, 1988. The main objectives of this committee are to contribute to reasonable criticality safety design/control through extensive discussions among the specialists of reactor physics, fuel treatment process and radiation surveillance technique and so on. The conferences were held totally seven times. This report concerns with the activities of this committee in the 2nd (1989) through 7th (1992) conferences. (author).

21736 (JAERI-Tech–95-025) **Calculational study on reactivity effect of pipe intersections.** Okuno, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Naito, Yoshitaka; Kaneko, Toshiyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 26p. (In Japanese). Order Number DE95780610. Source: OSTI; NTIS; INIS.

A simple formulation was proposed for evaluating the increment of reactivity due to the attachment of pipes to a vessel filled with fuel solution, and its validity was checked by numerical calculations. The formulation was based on the neutron balance equation which had been applied to the criticality safety analysis code MUTUAL for multi-unit systems, and the current formulation considered further the deviation of the representative neutron source point from the center of each pipe. The formulation was validated for models of 2- and 3-dimensional fuel systems by comparison with the precise calculations using the Monte Carlo code KENO-IV. For systems of pipes attached perpendicularly to the side of a cylindrical vessel, the size and number of negligible pipes were shown that corresponded to a very small increment (e.g. 0.3% $\Delta k/k$) of the neutron multiplication factor. (author).

21737 (LA–12556-C, pp. 12-20) **Verification of MMES five plant criticality software.** Petrie, L. (Oak Ridge National Lab., TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

Martin Marietta Energy Systems, Inc., has just finished installing and verifying a new set of nuclear criticality software for use by the criticality safety groups at the five plants operated by MMES for the DOE. This talk reports some of the results obtained in doing the verification of the KENOV.a code as well as some for the XSDRN code. The software codes installed are based on the latest version of the SCALE system, 4.1, but are maintained separately under an independent configuration control plan. The slides that follow give a number of analytically critical (K-eff=1.0) simple systems in spherical, cylindrically and slab geometry, followed by the results of calculating these systems with KENO and XSDRN. The cross section parameters and dimensions necessary to define these systems are given along with a picture to aid in visualizing the system. The

results show that KENO and XSDRN calculate these simple systems correctly, verifying the overall flow for these simple systems. For XSDRN these calculations cover most of the useful options available, but for KENO there are many geometric options for which there are no analytic solutions. For these systems it is necessary to do validation calculations against experiments to verify that the code correctly treats the more complicated geometries.

21738 (LA–12556-C, pp. 21-34) **Validation of MCNP for criticality calculations.** Briesmeister, J.F. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The MCNP philosophy focuses on three topics: quality, value, and new features, in that order. MCNP is a general-purpose continuous-energy Monte Carlo code developed and maintained by Group X-6 at the Los Alamos National Laboratory. Problems with neutrons, photons, and electrons as either single particle or coupled particles can be calculated with MCNP. When measurements are impractical, MCNP is an alternative calculational tool for comparison with other criticality computer codes and cross-section data bases. The primary focus of MCNP is quality. In addition to a long history and a wide variety of applications, MCNP has rigorous change control procedures, including peer review and code walkthroughs. We have established procedures by which the code is updated and of how problems are identified and corrected. A process of deciding what new features will be added exists, followed by a rigorous testing methods. New versions can be identified and are released in a controlled manner. Three benchmark documents exist, two prepared by LANL and one by GE. The documents have all the input files included as appendices so that anyone can duplicate identically the problems run. Contact X-6 to request copies of these documents.

21739 (LA–12556-C, pp. 35-49) **Validation of criticality safety calculations with subcriticality measurements by the ^{252}Cf-source-driven noise method.** Mihalczo, J.T. (Oak Ridge National Lab., TN (United States)); Krass, A.W.; Valentine, T.E.; Ficaro, E.P. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The ^{252}Cf-source-driven noise analysis method has successfully measured the subcritical neutron multiplication factor k for a wide variety of fissile systems. The recent modifications of the KENO Va Monte Carlo code to calculate directly the measured noise analysis data allow the use of this experimental data for validation of calculational methods and cross sections. High sensitivity of noise-measured parameters to small changes in fissile systems has been observed in several measurements. To investigate this sensitivity, a series of calculations was performed for a 3 by 3 array of PWR spent-fuel elements in unborated water. The macroscopic fission-product cross sections were changed, and the resulting ratios of spectral densities, coherence between detectors, and values of k were obtained from this Monte Carlo simulation of the measurement. The sensitivity of the ratios of spectral densities and coherences to changes in fission-product cross sections were a factor of 10 and 4°, respectively, more than that of k. These Monte Carlo calculations have shown that this type of subcritical measurement can be used to benchmark fission-product cross sections for spent PWR fuel and, because of the high sensitivity of the noise analysis quantities, would provide a more stringent test of the fission-product cross sections than comparison of calculation with experiments at delayed criticality, even though the value of k can be measured more accurately at delayed criticality.

21740 (LA–12556-C, pp. 50-52) **Criticality safety database.** Beasley, M.; Rutkowski, R. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Criticality Safety (NCS) Database is being developed by OSTI at the request of NE-74 to help workers in the area of nuclear criticality safety to accomplish their mission. It is a bibliographic database resident on the OSTI VAX cluster, and can be searched by BASIS software.

21741 (LA–12556-C, pp. 53-58) **Validation of MCNP with X6.XS cross-section set on the SUN Sparc Station 1+ computer for nominally 5 weight percent ^{235}U enriched uranium systems.** Lewis, K.D. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The national Atomic Vapor Laser Isotope Separation (AVLIS) project has conducted extensive nuclear criticality safety analyses both in the design of Uranium Demonstration System (UDS) equipment and in AVLIS plant design/plant deployment activities. Currently, the design limit of an AVLIS plant calls for uranium product enriched in ^{235}U to 5 wt %. Since an objective of an AVLIS plant is to deliver its product in a form readily usable by customers, uranium enriched in ^{235}U will appear in a variety of forms, including metallic; as oxides, e.g., UO_2, UO_3; as fluorides, e.g., UF_6, UF_4, UO_2F_2; as nitrates or nitrides, e.g., $UO_2(NO_3)_2$; and perhaps as uranium salts mixed with hydrocarbons such as oil. A wide range of neutron moderation levels, ranging from zero to optimal, and beyond can also be anticipated in an AVLIS plant, because of decontamination and cleaning activities and other wet chemistry processes that may be required.

21742 (LA–12556-C, pp. 60-63) **Regulatory impacts on code validation and use.** McKamy, J. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The Criticality Engineering Programs branch of Nuclear Safety Engineering at EG&G Rocky Flats is in the process of developing procedures for KENO code validation which demonstrate compliance with the requirements of DOE Order 5700.6B (NQA-1). Detailed and documented processes must be implemented to acquire, install, and validate the codes. Many of the requirements of DOE Order 5700.6B simply require documenting "good practices," while others are not possible due to the nature of verifying and validating 20-year-old codes against 30-year-old benchmarks.

21743 (LA–12556-C, pp. 64-65) **Validation philosophy.** Vornehm, D. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

To determine when a set of calculations falls within an umbrella of an existing validation documentation, it is necessary to generate a quantitative definition of range of applicability (our definition is only qualitative) for two reasons: (1) the current trend in our regulatory environment will soon make it impossible to support the legitimacy of a validation without quantitative guidelines; and (2) in my opinion, the lack of support by DOE for further critical experiment work is directly tied to our inability to draw a quantitative "line-in-the-sand" beyond which we will not use computer-generated values.

21744 (LA–12556-C, pp. 66-69) **The need for critical experiments.** Rothe, R.E. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality*

Safety Technology Project. 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

This article reports the authors opinion on the funding of criticality experiments in the United States. The author believes that the potential for nuclear criticality experiments in the country is on the rise, and should be keep in check by the construction of new laboratories or the refurbishment of existing facilities to study criticality safety.

21745 (LA–12556-C, pp. 70-80) **SHEBA: Modifications to a low-enrichment-solution critical assembly.** Butterfield, K.B. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The SHEBA solution assembly has been modified to operate either in a below-ground crypt to provide radiation shielding or aboveground for dosimetry measurements. Other modifications include better solution depth measurements, improved flow control, and possible burst operation capability. SHEBA uses 5% enriched uranyl fluoride fuel and is controlled with a digital process control system. The current status has the mechanical hardware completed and the approval for operations process started. Water tests are underway, and we are working to develop an ultrasonic-level measurements system that will have 0.1-mm resolution at the critical depth of ~ 40 cm.

21746 (LA–12556-C, pp. 95-106) **Evaluating criticality safety of TRU waste with NDA measurements and risk analyses.** Hochel, R.C.; Hofstetter, K.J.; Sigg, R.A.; Winn, W.G.; Chay, S.C. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The criticality safety of ^{239}Pu in 55-gal. drums stored in TRU waste containers (concrete culverts) was evaluated using NDA neutron and gamma measurements and risk analyses. The neutron measurements yielded a ^{239}Pu mass and k_{eff} for a culvert, which contains up to 14 drums. The gamma measurements helped reveal and correct for any interfering neutron sources in the waste. Conservation probabilistic risk analyses were developed for both drums and culverts.

21747 (LA–12556-C, pp. 107-110) **An improved criticality alarm system.** Tyree, W.H. (EG&G Rocky Flats, Golden, CO (United States)); Gilpin, H.E.; Balmer, D.K.; Vennitti, D.A. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The Rocky Flats Plant near Golden, Colorado is the primary facility for the production of plutonium components used in the US arsenal of nuclear weapons. It is operated by EG&G under contract to the US Department of Energy (DOE). There are ten production buildings on plant site with neutron based criticality alarm systems. These systems have been in operation for the past seventeen years. Changes in the interpretation of A.N.S.I. standards and DOE Orders have precipitated an evaluation of detector sensitivity and placement criteria. As a result of this evaluation, improvements in detector design and calibration have improved detector sensitivity by a factor of six. Testing performed on the design defined a minimum sensitivity as required by A.N.S.I. 8.3 and provided information for saturation and survivability for a fission event of up to $1X10^{17}$ fissions in 80 microseconds. A rigorous testing and calibration program has been developed and is in place. Neutron sensitivity is certified at a nearby reactor which is traceable to N.I.S.T.

21748 (LA–12556-C, pp. 111-119) **University programs: Benchmarking computer codes.** Busch, R. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a presentation and discussion of the features of the Lady Godiva test reactor and its present/past/future projects. The results of a number of geometries and enrichments were presented.

21749 (LA–12556-C, pp. 120-126) **Fissile solution dynamics: Student research.** Hetrick, D.L. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

There are two research projects in criticality safety at the University of Arizona: one in dynamic simulation of hypothetical criticality accidents in fissile solutions, and one in criticality benchmarks using transport theory. We have used the data from nuclear excursions in KEWB, CRAC, and SILENE to help in building models for solution excursions. An equation of state for liquids containing gas bubbles has been developed and coupled to point-reactor dynamics in an attempt to predict fission rate, yield, pressure, and kinetic energy. It appears that radiolytic gas is unimportant until after the first peak, but that it does strongly affect the shape of the subsequent power decrease and also the dynamic pressure.

21750 (LA–12556-C, pp. 127-131) **Nuclear Criticality Safety Program at the University of Tennessee - an overview.** Dodds, H.L. (Univ. of Tennessee, Knoxville, TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Criticality Safety (NCS) program at the University of Tennessee is a combined academic/research program for nuclear engineering students who desire special training in NCS. Although the program is oriented toward MS degree candidates, training is also available to senior undergraduates, via an introductory NCS course, as well as PhD candidates through dissertation research projects in the NCS area.

21751 (LA–12556-C, pp. 134-148) **Nuclear criticality safety order review.** Rosenbloom, S. Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was the presentation and discussion of a draft DOE 5480.CRIT, "Nuclear Criticality Safety."

21752 (LA–12556-C, pp. 207-209) **Criticality Safety Training (CRITSAF).** Halladay, S. (Westinghouse Hanford Co., Richland, WA (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was a brief description of a PC-based criticality safety training package. Software features and contents were noted, as well as hardware requirements.

21753 (LA–12556-C, pp. 233-237) **Evaluation techniques work group.** Choi, J.S. (Lawrence Livermore National Lab., CA (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was an overview of the evaluation techniques breakout session. Topics discussed were verification/validation of computer codes and criteria for subcriticality safety margin.

21754 (LA–12925-MS) **The NMT-5 criticality database.** Cort, B.; Perkins, B.; Cort, G. Los Alamos National Lab., NM (United States). May 1995. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012119. Source: OSTI; NTIS; INIS; GPO Dep.

The NMT-5 Criticality Database maintains criticality-related data and documentation to ensure the safety of workers handling special nuclear materials at the Plutonium Facility (TA-55) at Los Alamos National Laboratory. The database contains pertinent criticality safety limit information for more than 150 separate locations at which special nuclear materials are handled. Written in 4th Dimension for the Macintosh, it facilitates the production of signs for posting at these areas, tracks the history of postings and related authorizing documentation, and generates in Microsoft Word a current, comprehensive representation of all signs and supporting documentation, such as standard operating procedures and signature approvals. It facilitates the auditing process and is crucial to full and effective compliance with Department of Energy regulations. It has been recommended for installation throughout the Nuclear Materials Technology Division at Los Alamos.

21755 (LA-UR–95-692) **Cost effectiveness studies of environmental technologies: Volume 1.** Silva, E.M.; Booth, S.R. (eds.). Los Alamos National Lab., NM (United States). Feb 1994. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95007853. Source: OSTI; NTIS; INIS; GPO Dep.

This paper examines cost effectiveness studies of environmental technologies including the following: (1) In Situ Air Stripping, (2) Surface Towed Ordinance Locator System, (3) Ditch Witch Horizontal Boring Technology, (4) Direct Sampling Ion Trap Mass Spectrometer, (5) In Situ Vitrification, (6) Site Characterization and Analysis Penetrometer System, (7) In Situ Bioremediation, and (8) SEAMIST Membrane System Technology.

21756 (LA-UR–95-1336) **Science up to 100 tesla.** Campbell, L.J. (Los Alamos National Lab., NM (United States). National High Magnetic Field Lab.). Los Alamos National Lab., NM (United States). [1995]. 9p. DOE Contract W-7405-ENG-36. (CONF-9504132–4: Spring workshop on basic science using pulsed power, Santa Barbara, CA (United States), 5-7 Apr 1995). Order Number DE95012067. Source: OSTI; NTIS; GPO Dep.

100 Tesla is the highest attainable field that can be held for millisec in a non-destructive magnet. The strongest steels turn soft under stresses of 4GPa, which is the magnetic pressure of 100 T. Until there is a breakthrough in materials, magnets having all the low temperature and high pressure trimmings will be limited to about 100 T. Within the field range 1-100 T far more resources are now devoted to producing the highest possible continuous fields (40+5 T) than to producing longer pulsed fields above 50 T. This illustrates that the utility of the field can be more important than the strength of the field to researchers in condensed matter. Discoveries are typically made in new territory, but this can be new combinations of pressure, temperature, and magnetic field, or new probes and new materials. If any activity has kept up with the proliferation of new experiments and new facilities in high magnetic field research it is the listing of experiments that could and should be done in high fields. Part of the reason for the vitality of high field research is that high fields provide a generic environment. Compared to particle accelerators and plasma machines a high field laboratory is a setting for generic science, like synchrotron light sources or neutron scattering centers. Although the latter two installations probes states, while a magnetic field creates a state. Because it is unrealistic to try to list all the science opportunities at high fields, the author list sources for lists in the public domain and gives a few examples.

21757 (LBL–36749) **Multidimensional simulation studies of the SELENE FEL oscillator/buncher followed by a radiator/amplifier output scheme.** Hahn, S.J. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Fawley, W.M. Lawrence Berkeley Lab., CA (United States). Feb 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950226–49: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95012386. Source: OSTI; NTIS; GPO Dep.

We analyze and present numerical simulations of the so-called electron output scheme [G. I. Erg et al., 15th Int. FEL Conf., The Hague, The Netherlands, 1993, Book of Abstracts p. 50; Preprint Budker INP 93-75] applied to the SELENE proposal of using a high power FEL to illuminate satellite solar cells. In this scheme, a first stage FEL oscillator bunches the electron beam while a second stage "radiator" extracts high power radiation. Our analysis suggests only in the case where the radiator employs a long, tapered undulator will the electron output scheme produce a significant increase in extraction efficiency over what is obtainable from a simple, single-stage oscillator. 1- and 2-D numerical simulations of a 1.7μm FEL employing the electron output scheme show reasonably large bunching fractions ($\sim$ 0.3–0.4) at the output of the oscillator stage but only $\leq$2% extraction efficiency from the radiator stage.

21758 (NUREG/CR–5657) **AUTOCASK (AUTOmatic Generation of 3-D CASK models). A microcomputer based system for shipping cask design review analysis.** Gerhard, M.A. (Lawrence Livermore National Lab., CA (United States)); Sommer, S.C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Lawrence Livermore National Lab., CA (United States). Apr 1995. 128p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-48. (UCRL-ID–118766). Source: OSTI; NTIS; GPO; INIS.

AUTOCASK (AUTOmatic Generation of 3-D CASK models) is a microcomputer-based system of computer programs and databases developed at the Lawrence Livermore National Laboratory (LLNL) for the structural analysis of shipping casks for radioactive material. Model specification is performed on the microcomputer, and the analyses are performed on an engineering workstation or mainframe computer. AUTOCASK is based on 80386/80486 compatible microcomputers. The system is composed of a series of menus, input programs, display programs, a mesh generation program, and archive programs. All data is entered through fill-in-the-blank input screens that contain descriptive data requests.

21759 (NUREG/CR–6322) **Buckling analysis of spent fuel basket.** Lee, A.S. (Lawrence Livermore National Lab., CA (United States)); Bumpas, S.E. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Lawrence Livermore National Lab., CA (United States). May 1995. 45p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-48. (UCRL-ID–119697). Source: OSTI; NTIS; GPO; INIS.

The basket for a spent fuel shipping cask is subjected to compressive stresses that may cause global instability of the basket assemblies or local buckling of the individual members. Adopting the common buckling design practice in which the stability capacity of the entire structure is based on the performance of the individual members of the assemblies, the typical spent fuel basket, which is composed of plates and tubular structural members, can be idealized as an assemblage of columns, beam-columns and plates. This report presents the flexural buckling formulas for five load cases that are common in the basket buckling analysis: column under axial loads, column under axial and bending loads, plate under uniaxial loads, plate under biaxial loadings, and plate under biaxial loads and lateral pressure. The acceptance criteria from the ASME Boiler and Pressure Vessel Code are used to determine the adequacy of the basket components. Special acceptance criteria are proposed to address the unique material characteristics of austenitic stainless steel, a material which is frequently used in the basket assemblies.

21760 (ORNL/TM–12294/V.1) **SCALE-4 analysis of pressurized water reactor critical configurations. Volume 1: Summary.** DeHart, M.D. Oak Ridge National Lab., TN (United States). Mar 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95010421. Source: OSTI; NTIS; INIS; GPO Dep.

The requirements of ANSI/ANS 8.1 specify that calculational methods for away-from-reactor criticality safety analyses be validated against experimental measurements. If credit is to be taken for the reduced reactivity of burned or spent fuel relative to its original fresh composition, it is necessary to benchmark computational methods used in determining such reactivity worth against spent fuel reactivity measurements. This report summarizes a portion of the ongoing effort to benchmark away-from-reactor criticality analysis methods using critical configurations from commercial pressurized water reactors (PWR). The analysis methodology utilized for all calculations in this report is based on the modules and data associated with the SCALE-4 code system. Each of the five volumes comprising this report provides an overview of the methodology applied. Subsequent volumes also describe in detail the approach taken in performing criticality calculations for these PWR configurations: Volume 2 describes criticality calculations for the Tennessee Valley Authority's Sequoyah Unit 2 reactor for Cycle 3; Volume 3 documents the analysis of Virginia Power's Surry Unit 1 reactor for the Cycle 2 core; Volume 4 documents the calculations performed based on GPU Nuclear Corporation's Three Mile Island Unit 1 Cycle 5 core; and, lastly, Volume 5 describes the analysis of Virginia Power's North Anna Unit 1 Cycle 5 core. Each of the reactor-specific volumes provides the details of calculations performed to determine the effective multiplication factor for each reactor core for one or more critical configurations using the SCALE-4 system; these results are summarized in this volume. Differences between the core designs and their possible impact on the criticality calculations are also discussed. Finally, results are presented for additional analyses performed to verify that solutions were sufficiently converged.

21761 (ORNL/TM–12294/V.2) **SCALE-4 analysis of pressurized water reactor critical configurations. Volume 2: Sequoyah Unit 2 Cycle 3.** Bowman, S.M.; Hermann, O.W.; Brady, M.C. Oak Ridge National Lab., TN (United States). Mar 1995. 229p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95010426. Source: OSTI; NTIS; INIS; GPO Dep.

The requirements of ANSI/ANS 8.1 specify that calculational methods for away-from-reactor criticality safety analyses be validated against experimental measurements. If credit for the negative reactivity of the depleted (or spent) fuel isotopics is desired, it is necessary to benchmark computational methods against spent fuel critical configurations. This report summarizes a portion of the ongoing effort to benchmark away-from-reactor criticality analysis methods using critical configurations from commercial pressurized-water reactors. The analysis methodology selected for all the calculations reported herein is based on the codes and data provided in the SCALE-4 code system. This volume of the report documents the SCALE system analysis of three reactor critical configurations for the Sequoyah Unit 2 Cycle 3. This unit and cycle were chosen because of the relevance in spent fuel benchmark applications: (1) the unit had a significantly long downtime of 2.7 years during the middle of cycle (MOC) 3, and (2) the core consisted entirely of burned fuel at the MOC restart. The first benchmark critical calculation was the MOC restart at hot, full-power (HFP) critical conditions. The other two benchmark critical calculations were the beginning-of-cycle (BOC) startup at both hot, zero-power (HZP) and HFP critical conditions. These latter calculations were used to check for consistency in the calculated results for different burnups and downtimes. The k_{eff} results were in the range of 1.00014 to 1.00259 with a standard deviation of less than 0.001.

21762 (ORNL/TM–12294/V.3) **SCALE-4 analysis of pressurized water reactor critical configurations. Volume 3: Surry Unit 1 Cycle 2.** Bowman, S.M.; Hermann, O.W. Oak Ridge National Lab., TN (United States). Mar 1995. 173p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95010428. Source: OSTI; NTIS; INIS; GPO Dep.

The requirements of ANSI/ANS 8.1 specify that calculational methods for away-from-reactor criticality safety analyses be validated against experimental measurements. If credit for the negative reactivity of the depleted (or spent) fuel isotopics is desired, it is necessary to benchmark computational methods against spent fuel critical configurations. This report summarizes a portion of the ongoing effort to benchmark away-from-reactor criticality analysis methods using selected critical configurations from commercial pressurized-water reactors. The analysis methodology selected for all the calculations in this report is based on the codes and data provided in the SCALE-4 code system. This volume of the report documents the SCALE system analysis of two reactor critical configurations for Surry Unit 1 Cycle 2. This unit and cycle were chosen for a previous analysis using a different methodology because detailed isotopics from multidimensional reactor calculations were available from the Virginia Power Company. These data permitted a direct comparison of criticality calculations using the utility-calculated isotopics, with those using, the isotopics generated by the SCALE-4 SAS2H sequence. These reactor critical benchmarks have been reanalyzed using the methodology described above. The two benchmark critical calculations were the beginning-of-cycle (BOC) startup at hot, zero-power (HZP) and an end-of-cycle (EOC) critical at hot, full-power (HFP) critical conditions. These calculations were used to check for consistency in the calculated results for different burnup, downtime, temperature, xenon, and boron conditions. The k_{eff} results were 1.0014 and 1.0113, respectively, with a standard deviation of 0.0005.

21763 (ORNL/TM–12294/V.4) **SCALE-4 analysis of pressurized water reactor critical configurations. Volume 4: Three Mile Island Unit 1 Cycle 5.** DeHart, M.D. Oak Ridge National Lab., TN (United States). Mar 1995. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95010427. Source: OSTI; NTIS; INIS; GPO Dep.

The requirements of ANSI/ANS-8.1 specify that calculational methods for away-from-reactor criticality safety analyses be validated against experimental measurements. If credit is to be taken for the reduced reactivity of burned or spent fuel relative to its original fresh composition, it is necessary to benchmark computational methods used in determining such reactivity worth against spent fuel reactivity measurements. This report summarizes a portion of the ongoing effort to benchmark away-from-reactor criticality analysis methods using relevant and well-documented critical configurations from commercial pressurized water reactors. The analysis methodology utilized for all calculations in this report is based on the modules and data associated with the SCALE-4 code system. This volume of the report documents a reactor critical calculation for GPU Nuclear Corporation's Three Mile Island Unit 1 (TNU-1) during hot, zero-power startup testing for the beginning of cycle 5. This unit and cycle were selected because of their relevance in spent fuel benchmark applications: (1) cycle 5 startup occurred after an especially long downtime of 6.6 years; and (2) the core consisted primarily (75%) of burned fuel, with all fresh fuel loaded on the core outer periphery. A k_{eff} value of 0.9978 $\pm$ 0.0004 was obtained using two million neutron histories in the KENO V.a model. This result is close to the known critical k_{eff} of 1.0 for the actual core and is consistent with other mixed-oxide criticality benchmarks. Thus this method is shown to be valid for spent fuel applications in burnup credit analyses.

21764 (ORNL/TM–12816) **Enhanced code for the full space parameterization approach to solving underspecified systems of algebraic equations: Version 1.0.** Morgansen, K.A.; Pin, F.G. Oak Ridge National Lab., TN (United States). Mar 1995. 68p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012544. Source: OSTI; NTIS; GPO Dep.

This paper describes an enhanced version of the code for the Full Space Parameterization (FSP) method that has recently been presented for determining optimized (and possibly constrained) solutions, x, to underspecified system's of algebraic equations b = Ax. The enhanced code uses the conditions necessary for linear independence of the m – n + 1 vectors forming the solution as a basis for an efficient search pattern to quickly find the full set of solution vectors. A discussion is made of the complications which may be present due to the particular combination of the matrix A and the vector b. The first part of the code implements the various methods needed to handle these particular cases before the solution vectors are calculated so that computation time may be decreased. The second portion of the code implements methods

which can be used to calculate the necessary solution vectors. The respective expressions of the full solution space, S, for the cases of the matrix A being full rank and rank deficient are given. Finally, examples of the resolution of particular cases are provided, and a sample application to the joint motion of a mobile manipulator for a given end-effector trajectory is presented.

21765 (RFP–4954) **Technology development: HEPA filter service life test plan.** Kirchner, K.N.; Cummings, K.G.; Leck, W.C.; Fretthold, J.K. Rocky Flats Environmental Technology Site, Golden, CO (United States). 31 May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. Order Number DE95013235. Source: OSTI; NTIS; GPO Dep.

Rocky Flats Environmental Technology Site (the Site) has approximately 10,000 High Efficiency Particulate Air (HEPA) Filters installed in a variety of filter plenums. These ventilation/filtration plenum systems are used to control the release of airborne particulate contaminates to the environment during normal operations and also during potential design-based accidents. The operational integrity of the HEPA filter plenums is essential to maintaining the margins of safety as required by building specific Final Safety Analysis Reports (FSARS) for protection of the public and environment. An Unreviewed Safety Question Determination (USQD), USDQ-RFP94.0615-ARS, was conducted in 1994 addressing the potential inadequacy of the safety envelope for Protected Area building HEPA plenums. While conducting this USQD, questions were raised concerning the maximum service life criteria for HEPA filters. Accident scenarios in existing FSARs identify conditions that could potentially cause plugging or damage of down stream HEPA filters as a result of impaction from failed filters. Additionally, available data indicates that HEPA filters experience structural degradation due to the effects of age. The Unresolved Safety Question (USQ) compensatory measures thus require testing and analysis of used HEPA filters in order to determine and implement service life criteria.

21766 (RFP–4999) **TRUPACT-II residue pipe payload container.** Geinitz, R. (Rocky Flats Environmental Technology Site, Golden, CO (United States)); Gregory, P. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9506150–3: 2. annual Department of Energy defense programs packaging workshop, San Francisco, CA (United States), 12-15 Jun 1995). Order Number DE95012986. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes the project to develop, test and certify a new payload container for the TRUPACT-II, a Type B packaging for the shipment of transuranic waste. The new payload container will provide segregation of plutonium waste materials within the TRUPACT-II. This segregation of fissile contents will support a new criticality safety analysis that may allow an increase in the TRUPACT-II Pu-239 Fissile Gram Equivalent (FGE) limit from 325 grams to 2800 grams. The need for this project was brought about by the end of the Cold War and the resulting shift in value of plutonium residues from providing recoverable Defense Program material to being considered disposable waste. This paper will not cover many of the details of the project but will instead aim to provide a general picture of all the project activities.

21767 (SAND–94-2748C) **A dimensionless parameter model for arc welding processes.** Fuerschbach, P.W. Sandia National Labs., Albuquerque, NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950682–1: 4. international conference on trends in welding research, Gatlinburg, TN (United States), 5-9 Jun 1995). Order Number DE95013861. Source: OSTI; NTIS; GPO Dep.

A dimensionless parameter model previously developed for $C0_2$ laser beam welding has been shown to be applicable to GTAW and PAW autogenous arc welding processes. The model facilitates estimates of weld size, power, and speed based on knowledge of the material's thermal properties. The dimensionless parameters can also be used to estimate the melting efficiency, which eases development of weld schedules with lower heat input to the weldment. The mathematical relationship between the dimensionless parameters in the model has been shown to be dependent on the heat flow geometry in the weldment.

21768 (SAND–95-0503C) **Application of three dimensional finite element analysis to electron beam welding of a high pressure compressor drum rotor.** Cowles, J.H. Jr. (Ingenium Technologies Group, Inc., Somers, CT (United States)); Blanford, M.; Giamei, A.F.; Bruskotter, M.J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9509118–1: Modeling of casting, welding and advanced solidification processes 7, London (United Kingdom), 10-15 Sep 1995). Order Number DE95008817. Source: OSTI; NTIS; GPO Dep.

Finite Element Analysis capability for application to welding has been developed and enhanced during a two year Cooperative Research and Development Agreement(CRADA) between Pratt & Whitney, United Technologies Research Center, and Sandia National Laboratories. Because of the nature of electron beam welding at Pratt & Whitney – set-up is time consuming, the parts to be welded are complicated, and experimentation is costly – finite element analysis has found many potential applications. The results of most interest in these analyses are the residual stress and final distortion of the component. The work has made use of the Sandia finite element codes JACQ3D, for thermal analysis, and JAS3D, for mechanical analysis. Both codes use an efficient, nonlinear conjugate gradient solution technique, which enables large problems to be solved on engineering workstations. This presentation describes several technical challenges that were overcome in the application of the Sandia codes to this class of problems. Stress and distortion results predicted for an electron beam weld of a PW4000 gas turbine engine drum rotor will also be discussed.

21769 (SAND–95-0722) **Learning to improve path planning performance.** Chen, Pang C. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012997. Source: OSTI; NTIS; INIS; GPO Dep.

In robotics, path planning refers to finding a short. collision-free path from an initial robot configuration to a desired configuratioin. It has to be fast to support real-time task-level robot programming. Unfortunately, current planning techniques are still too slow to be effective, as they often require several minutes, if not hours of computation. To remedy this situation, we present and analyze a learning algorithm that uses past experience to increase future performance. The algorithm relies on an existing path planner to provide solutions to difficult tasks. From these solutions, an evolving sparse network of useful robot configurations is learned to support faster planning. More generally, the algorithm provides a speedup-learning framework in which a slow but capable planner may be improved both cost-wise and capability-wise by a faster but less capable planner coupled with experience. The basic algorithm is suitable for stationary environments, and can be extended to accommodate changing environments with on-demand experience repair and object-attached experience abstraction. To analyze the algorithm, we characterize the situations in which the adaptive planner is useful, provide quantitative bounds to predict its behavior, and confirm our theoretical results with experiments in path planning of manipulators. Our algorithm and analysis are sufficiently, general that they may also be applied to other planning domains in which experience is useful.

21770 (SAND–95-0843) **System identification for robust control design.** Dohner, J.L. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012530. Source: OSTI; NTIS; GPO Dep.

System identification for the purpose of robust control design involves estimating a nominal model of a physical system and the uncertainty bounds of that nominal model via the use of experimentally measured input/output data. Although many algorithms have been developed to identify nominal models, little effort has been directed towards identifying uncertainty bounds. Therefore, in this document, a discussion of both nominal model identification and bounded output multiplicative uncertainty identification will be

presented. This document is divided into several sections. Background information relevant to system identification and control design will be presented. A derivation of eigensystem realization type algorithms will be presented. An algorithm will be developed for calculating the maximum singular value of output multiplicative uncertainty from measured data. An application will be given involving the identification of a complex system with aliased dynamics, feedback control, and exogenous noise disturbances. And, finally, a short discussion of results will be presented.

21771 (SAND–95-0969C) **Design and analysis of a high-performance shipping container for large payloads.** York, A.R. II; Slavin, A.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506150–2: 2. annual Department of Energy defense programs packaging workshop, San Francisco, CA (United States), 12-15 Jun 1995). Order Number DE95011879. Source: OSTI; NTIS; INIS; GPO Dep.

The packaging, designated the H1636A is a high-performing packageing for large payloads. The H1636A is 50 in. in diameter and 113 in. in length and weighs approximately 4600 lb when empty. The design objective was to meet 1996 proposed IAEA Type C criteria for air transport of large quantities of radioactive material (RAM). That is, the package should survive the standard Type B tests and more severe tests such as an impact onto an unyielding target at 280 ft/s and a one-hour jet fuel fire. The packaging consists of a large double-walled stainless steel outer drum filled with uniform density polyurethane foam. A stainless steel containment vessel (CV) with an inside diameter of 23 in. and a length of 78 in. carries the RAM. The CV has a nominal thickness of 0.375 in. and seals with two elastomeric 0-rings. The lid of the CV is joined to the body with a unique closure called a tape joint. The tape joint utilizes interlocking features preloaded with wedges and can withstand significant deformation.

21772 (SAND–95-1001C) **Risk from transportation of nuclear explosives and nuclear components by safe-secure trailer.** Copus, E.R.; Clauss, D.B.; Wilson, R.K. Sandia National Labs., Albuquerque, NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506150–1: 2. annual Department of Energy defense programs packaging workshop, San Francisco, CA (United States), 12-15 Jun 1995). Order Number DE95011880. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy ships nuclear explosives, nuclear components and other special nuclear material (SNM) in support of Defense Programs activities. The primary mode of transportation is by public highways using the Armored Tractor/Safe-Secure Trailer (AT/SST), which was designed and equipped specifically for this mission. This paper will provide a description of the methodology and a summary of the results obtained in the Defense Programs Transportation Risk Assessment (DPTRA) study. The DPTRA study entailed a probabilistic transportation risk assessment conducted to assess the probability and consequences of inadvertent dispersal of radioactive materials arising from severe transportation accidents and from exposures associated with intrinsic radiation during incident-free transportation. The risk analysis incorporates statistics on the probabilities and severities of tractor semitrailer accidents; test data and engineering models to assess the response of the AT/SST and its cargo to the accident environment; and detailed route characterization to assess accident rates, probabilities of different meteorological conditions and population exposure. Uncertainties are considered in most of the input parameters using the Latin-Hypercube Sampling (LHS) technique. The results indicate the magnitude of the risk involved and the dominant contributors to risk.

21773 (SAND–95-1192C) **Empirical verification of fine-motoion planning theories.** Brost, R.C. (Sandia National Labs., Albuquerque, NM (United States)); Christiansen, A.D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506196–1: ISER 95: 4. international symposium on experimental bobotics, Stanford, CA (United States), 30 Jun - 2 jul 1995). Order Number DE95013869. Source: OSTI; NTIS; GPO Dep.

Successful robot systems must employ actions that are robust in the face of task uncertainty. Toward this end, Lozano-Perez, Mason, and Taylor developed a model of manipulation tasks that explicitly considers task uncertainty. In this paper we study the utility of this model applied to real-world tasks. We report the results of two experiments that highlight the strengths and weaknesses of the LMT approach. The first experiment showed that the LMT formalism can successfully plan solutions for a complex real-world task. The second experiment showed a task that the formalism is fundamentally incapable of solving.

21774 (UCRL-ID–119334) **Light Emitting Diode (LED) fiducial system: Setup and operation.** Muelder, S.A. Lawrence Livermore National Lab., CA (United States). Jan 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013289. Source: OSTI; NTIS; GPO Dep.

Streak cameras, either electronic or rotating mirror, are common diagnostic tools used to explore very fast phenomena. Often they are used to precisely time events or durations, and in most cases, it is important to have quality time marks on the film record. Many methods have been used to introduce time marks onto the film. Exploding bridge wires are frequently used, but they light up slowly and are difficult to read with consistent accuracy. It is also difficult to put more than a few bridge wires in the view of a camera slit, so there are only a few timing marks written to the film. In some cases the time scale on the film must be interpolated over long distances, creating a significant loss of accuracy. Interpolation is especially troublesome with those cameras that have a nonlinear sweep rate. Spark gaps located on the camera slit turn on a bit faster, but suffer from the same interpolation induced errors. A series of short duration laser pulses, accurately timed and introduced along the edges of the film, is a very fine solution. The problem with such a laser fiducial system is that the lasers are very expensive and difficult to maintain. There has been a need for many years for an inexpensive, very bright light source that can be repetitively pulsed accurately and with short duration. Various technologies have sufficiently developed over the past few years, allowing us to build a fiducial system based on light emitting diodes (LED) for the Cordin rotating mirror streak cameras.

21775 (UCRL-JC–115891-Rev.1) **Preliminary studies to determine the shelf life of HEPA filters. Revision 1.** Gilbert, H.; Fretthold, J.K.; Rainer, F.; Bergman, W.; Beason, D. Lawrence Livermore National Lab., CA (United States). Feb 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940738–8-Rev.1: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE95011428. Source: OSTI; NTIS; INIS; GPO Dep.

We have completed a preliminary study using filter media tests and filter qualification tests to investigate the effect of shelf-life on HEPA filter performance. Our media studies showed that the tensile strength decreased with age, but the data were not sufficient to establish a shelf-life. Thermogravimetric analyses demonstrated that one manufacturer had media with low tensile strength due to insufficient binder. The filter qualification tests (heated air and overpressure) conducted on different aged filters showed that filter age is not the primary factor affecting filter performance; materials and the construction design have a greater effect. An unexpected finding of our study was that sub-standard HEPA filters have been installed in DOE facilities despite existing regulations and filter qualification tests. We found that the filter with low tensile strength failed the overpressure test. The same filter had passed the heated air test, but left the filter so structurally weak, it was prone to blow-out. We recommend that DOE initiate a filter qualification program to prevent this occurrence.

21776 (UCRL-JC–117059) **Robotic control architecture development for automated nuclear material handling systems.** Merrill, R.D.; Hurd, R.; Couture, S.; Wilhelmsen, K. Lawrence Livermore National Lab., CA (United States). Feb 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950232–35: 6. American Nuclear Society meeting on robotics and remote systems, Monterey, CA (United

States), 5-10 Feb 1995). Order Number DE95013426. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) is engaged in developing automated systems for handling materials for mixed waste treatment, nuclear pyrochemical processing, and weapon components disassembly. In support of these application areas there is an extensive robotic development program. This paper will describe the portion of this effort at LLNL devoted to control system architecture development, and review two applications currently being implemented which incorporate these technologies.

21777 (UCRL-JC–117143) **Thin film conductive polymer for microactuator and micromuscle applications.** Lee, A.P.; Hong, K.; Trevino, J.; Northrup, M.A. Lawrence Livermore National Lab., CA (United States). 14 Apr 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941142–33: American Society of Mechanical Engineers' winter annual meeting, Chicago, IL (United States), 6-11 Nov 1994). Order Number DE95011744. Source: OSTI; NTIS; GPO Dep.

Conductive polymer/polyimide bimorphic microcantilevers have been actuated vertically (out-of-plane) upon the volumetric changes induced by electrochemical doping of the polymer. The microcantilevers that are 200-500 μm in length and 50-100 μm in width can be fully extended from a circularly-curled geometry, and thus generate more than 100 μm displacement. Dynamically the microcantilevers have been driven as fast as 1.2 Hz and the polymer was stable for over a week stored in air and light. Residual stresses in the polymer film is estimated to be as high as 254 MPa, and actuation stresses are as high as 50 MPa.

21778 (UCRL-JC–117457) **Modal analysis of PATHFINDER unmanned air vehicle.** Woehrle, T.G.; Costerus, B.W.; Lee, C.L. Lawrence Livermore National Lab., CA (United States). 19 Oct 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950240–5: International modal analysis conference, Nashville, TN (United States), 13-16 Feb 1995). Order Number DE95014127. Source: OSTI; NTIS; GPO Dep.

An experimental modal analysis was performed on PATHFINDER, a 450-lb, 100-ft wing span, flying-wing-design aircraft powered by solar/electric motors. The aircraft was softly suspended and then excited using random input from a long-stroke shaker. Modal data was taken from 92 measurement locations on the aircraft using newly designed, lightweight, tri-axial accelerometers. A conventional PC-based data acquisition system provided data handling. Modal parameters were calculated, and animated mode shapes were produced using SMS STARStruct™ Modal Analysis System software. The modal parameters will be used for validation of finite element models, optimum placement of onboard accelerometers during flight testing, and vibration isolation design of sensor platforms.

21779 (UCRL-JC–117980-Rev.1) **Analysis of interaction phenomena between liquid jets and materials. Revision 1.** Kang, S.W.; Reitter, T.; Carlson, G. Lawrence Livermore National Lab., CA (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950853–1-Rev.1: ASME/JSME annual summer meeting of the Fluids Engineering conference, Hilton Head, SC (United States), 13-17 Aug 1995). Order Number DE95011519. Source: OSTI; NTIS; GPO Dep.

The interaction phenomena of high-velocity liquid jets impinging on a material surface have been investigated theoretically and experimentally to understand the physics of material removal by jet-machining processes. Experiments were performed to delineate conditions under which liquid jet impacts will cause mass removal, and to determine optimum jet-cutting conditions. Theoretical analyses have also been carried out to study the effects of multiple jet-droplet impacts on a target surface as a material deformation mechanism. The calculated target response and spallation behavior following droplet impacts and their physical implications are also discussed.

21780 (UCRL-JC–118757) **Diode laser absorption spectroscopy for process control: Sensor system design methodology.** Berzins, L.V.; Anklam, T.M.; Chambers, F.; Galanti, S.; Haynam, C.A.; Worden, E.F. Lawrence Livermore National Lab., CA (United States). Mar 1995. 25p. Sponsored by USDOE, Washington, DC (United States):Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950454–1: 22. international AVS conference on metallurgical coatings and thin films, San Diego, CA (United States), 24-28 Apr 1995). Order Number DE95011801. Source: OSTI; NTIS; INIS; GPO Dep.

A laser absorption spectroscopy (LAS) system has been developed at Lawrence Livermore National Laboratory (LLNL) for process control. LAS has proven itself to be an accurate and reliable method to monitor both density and composition. In this paper the important features and components of an industrial LAS diagnostic are described. Application of this approach to vaporization processes requires careful selection of the species and transitions to be monitored The relative vapor pressure, hyperfine structure, isotopic frequency shifts, and electronic temperature all effect the selection of a particular transition. In this paper we describe the methodology for choosing the optimal transition or transitions. Coevaporation of a titanium-niobium alloy is used to illustrate the methodology. In a related paper, T.M. Anklam et al describe the application of this diagnostic to monitoring and controlling composition in a physical vapor deposition process of industrial interest.

21781 (UCRL-JC–118897) **Automated system for handling tritiated mixed waste.** Dennison, D.K.; Merrill, R.D.; Reitz, T.C. Lawrence Livermore National Lab., CA (United States). Mar 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950877–7: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95011842. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) is developing a semi system for handling, characterizing, processing, sorting, and repackaging hazardous wastes containing tritium. The system combines an IBM-developed gantry robot with a special glove box enclosure designed to protect operators and minimize the potential release of tritium to the atmosphere. All hazardous waste handling and processing will be performed remotely, using the robot in a teleoperational mode for one-of-a-kind functions and in an autonomous mode for repetitive operations. Initially, this system will be used in conjunction with a portable gas system designed to capture any gaseous-phase tritium released into the glove box. This paper presents the objectives of this development program, provides background related to LLNL's robotics and waste handling program, describes the major system components, outlines system operation, and discusses current status and plans.

21782 (UCRL-JC–119862) **Rigid bodies for metal forming analysis with NIKE3D.** Maker, B.N. Lawrence Livermore National Lab., CA (United States). 25 Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506144–4: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United States), 18-21 Jun 1995). Order Number DE95011740. Source: OSTI; NTIS; GPO Dep.

Perhaps the most common approximation in engineering is that, relative to its neighbors, a system component is structurally rigid. This paper presents a development of the rigid assumption for use in nonlinear, implicit finite element codes. In this method, computational economy is gained by condensing the size of the associated linear system of equations, eliminating the processing of rigid elements, and reducing the overall nonlinearity of the problem.

21783 (UCRL-JC–120410) **Modeling of profile effects for the LLNL Large Area Inductively Coupled Plasma Source.** Vitello, P. (and others); Parker, G.J.; Tishchenko, N. Lawrence Livermore National Lab., CA (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950875–3: International symposium on plasma chemistry, Minneapolis, MN (United States), 21-25 Aug 1995). Order Number DE95013322. Source: OSTI; NTIS; GPO Dep.

Inductively coupled plasma (ICP) sources are one of the most important high density plasma configurations developed in recent

years. Next generation technology requires plasma processing systems with high uniformity over very large areas. The authors present here a comparison between computer modeling and experimental results from the LLNL Large Area ICP Source. The LLNL experiment has a 30 inches diameter and is designed to study 400mm. processing. Computer simulations using the fluid code, INDUCT94, are used to explain variations in the plasma density profile measurements as a function of inductive power and gas pressure. Trends in density profile versus pressure and power found in the simulation match those found in the experiment. Uniformity of the order of several percent was found to be possible over a 400mm diameter area.

21784 (UCRL-JC–120508) **Oxide vapor distribution from a high-frequency sweep e-beam system.** Chow, R.; Tassano, P.L.; Tsujimoto, N. Lawrence Livermore National Lab., CA (United States). Mar 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504155–1: 38. annual technical conference of the Society of Vacuum Coaters, Chicago, IL (United States), 2-7 Apr 1995). Order Number DE95011446. Source: OSTI; NTIS; GPO Dep.

Oxide vapor distributions have been determined as a function of operating parameters of a high frequency sweep e-beam source combined with a programmable sweep controller. We will show which parameters are significant, the parameters that yield the broadest oxide deposition distribution, and the procedure used to arrive at these conclusions. A design-of-experimental strategy was used with five operating parameters: evaporation rate, sweep speed, sweep pattern (pre-programmed), phase speed (azimuthal rotation of the pattern), profile (dwell time as a function of radial position). A design was chosen that would show which of the parameters and parameter pairs have a statistically significant effect on the vapor distribution. Witness flats were placed symmetrically across a 25 inches diameter platen. The stationary platen was centered 24 inches above the e-gun crucible. An oxide material was evaporated under 27 different conditions. Thickness measurements were made with a stylus profilometer. The information will enable users of the high frequency e-gun systems to optimally locate the source in a vacuum system and understand which parameters have a major effect on the vapor distribution.

21785 (UCRL-JC–120583) **Tension in the tie-down chains of a shipping container for hazardous material.** Lo, T.Y. Lawrence Livermore National Lab., CA (United States). 17 Mar 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950740–35: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95011436. Source: OSTI; NTIS; INIS; GPO Dep.

Chains are frequently used to tie the shipping containers of hazardous material to a truck bed. The tie-down system is nonlinear when the container is subjected to a triaxial force during transit. It is nonlinear because chains cannot carry compressive force, and the base of the container may partially lift off from the truck bed. A method was developed to calculate the amount of tension in the chains. This methodology includes three assumptions: (1) No friction exists between the container and the truck bed; (2) The container and the truck bed are rigid; and (3) All chains are properly tightened (i.e., no slacks) during preparation for shipment. The methodology employs an iterative process of a linear tie-down system. This linear system is derived from the nonlinear system with two additional assumptions: (a) All chains can carry compression as well as tension; and (b) There is a point contact between the container and the truck bed. This linear system has a closed-form solution. After the first solution of the linear system is obtained, the unreasonable, or physically impossible, rotational degree of freedom of the container and the chains with compressive force are eliminated in the follow-up iterative calculations using the same linear system. Unreasonable rotation is detected when the results indicate a rotation of the container into the truck bed. Zero rotational value is assigned to this degree of freedom in the follow-up iterations. For chains under compression, the chain length is replaced with a fictitiously large value because a long chain carries essentially no load. This process usually needs only two or three iterations and can easily be carried out in a spread sheet using such programs as Microsoft Excel or LOTUS 123.

21786 (WHC-SD-CP-TI–171) **Flowsheet for shear/leach processing of N Reactor fuel at PUREX.** Enghusen, M.B. Westinghouse Hanford Co., Richland, WA (United States). 13 Apr 1995. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011573. Source: OSTI; NTIS; INIS; GPO Dep.

This document was originally prepared to support the restart of the PUREX plant using a new Shear/Leach head end process. However, the PUREX facility was shutdown and processing of the remaining N Reactor fuel is no longer considered an alternative for fuel disposition. This document is being issued for reference only to document the activities which were investigated to incorporate the shear/leach process in the PUREX plant.

21787 (WHC-SD-TP-RPT–020) **Final evaluation report for a U.S. Department of Transportation Specification 7A Type A Radioactive Material Packaging, Lockheed Idaho Technologies Company (LITCO), Mark III Concrete Container, Docket 92-33-7A.** Kelly, D.L. Westinghouse Hanford Co., Richland, WA (United States). 24 Mar 1995. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010563. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the U.S. Department of Transportation Specification 7A Type A (DOT-7A) compliance test results of the Mark III Concrete Container. The authorized configuration consists of the Mark III Concrete Container with a two-piece, welded, polyethylene liner (lid and body), polyethylene foam gasket, and six coil bolts and washers. A vent plug exists in the lid of the container. Two plugs are located on the side of the container body (lower portion), and allow the access to a ball valve. Two plugs are located underneath the bottom of the container body, near these side plugs. To drain the box, the bottom plugs need to be removed. The side plugs are then removed, allowing access to the ball valve. When the ball valve is opened, drainage occurs through the bottom drain area. After drainage, no residual liquid is permitted. The packaging may be used with or without the top wooden impact limiter. This packaging was evaluated and tested in August and October 1994. The packaging configurations described in this report are designed to ship Type A quantities of solid radioactive materials, Form No. 1, Form No. 2, and Form No. 3.

21788 (WHC-SP–0856-Rev.2) **Maintenance implementation plan for T Plant. Revision 2.** Ayers, W.S. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013579. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a Maintenance Implementation Plan (MIP) for the T Plant Facility complex located in the 200 West Area of the Hanford Reservation in Washington state. This plan has been developed to provide a disciplined approach to maintenance functions and to describe how the T Plant facility will implement and comply with the regulations according to US DOE order 4330.4B, entitled Maintenance Management Program, Chapter 2.0 "Nuclear Facilities". Physical structures, systems, processes, as well as all associated equipment specifically assigned to these groups are included in the MIP.

21789 (WSRC-MS–95-0116) **Normal Condition on Transport Thermal Analysis and Testing of a Type B Drum Package.** Jerrell, J.W.; van Alstine, M.N.; Gromada, R.J. Westinghouse Savannah River Co., Aiken, SC (United States). 21 Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9506194–1: 1995 PVP conference, Livermore, CA (United States), 12-14 Jun 1995). Order Number DE95060132. Source: OSTI; NTIS; INIS; GPO Dep.

Increasing the content limits of radioactive material packagings can save money and increase transportation safety by decreasing the total number of shipments required to transport large quantities of material. The contents of drum packages can be limited by unacceptable containment vessel pressures and temperatures due to the thermal properties of the insulation. The purpose of this work is

to understand and predict the effects of insulation properties on containment system performance.

21790 (WSRC-MS–95-0197) **Heat Transfer in Cane Fiberboard Exposed to Hypothetical Accident Conditions.** Gromada, R.J. Westinghouse Savannah River Co., Aiken, SC (United States). 25 May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9506150–4: 2. annual Department of Energy defense programs packaging workshop, San Francisco, CA (United States), 12-15 Jun 1995). Order Number DE95060148. Source: OSTI; NTIS; GPO Dep.

Radioactive material packages containing fiberboard insulation have been subjected to Hypothetical Accident Condition (HAC) thermal tests for many years. Historically, the packages' thermal performance has always been difficult to grasp. A package designer needs to understand the effects of temperature and pyrolysis on the rate of heat transfer and performance. This paper describes in detail the one-dimensional HAC thermal tests performed on fiberboard to understand the effects of pyrolysis, its char and its gas products. The tests were conducted by the Packaging and Transportation Group at the Savannah River Site (SRS). Test fixtures were assembled at SRS and thermal testing conducted in the Radiant Heat Facility at the Sandia National Laboratories. Descriptions of the test fixtures are provided, as well as the time dependent temperature profiles. In addition, lessons learned are discussed.

21791 (WSRC-TR–94-0402) **Burst Test Qualification Analysis of DWPF Canister-Plug Weld.** Gupta, N.K.; Gong, Chung. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060133. Source: OSTI; NTIS; INIS; GPO Dep.

The DWPF canister closure system uses resistance welding for sealing the canister nozzle and plug to ensure leak tightness. The welding group at SRTC is using the burst test to qualify this seal weld in lieu of the shear test in ASME B&PV Code, Section IX, paragraph QW-196. The burst test is considered simpler and more appropriate than the shear test for this application. Although the geometry, loading and boundary conditions are quite different in the two tests, structural analyses show similarity in the failure mode of the shear test in paragraph QW-196 and the burst test on the DWPF canister nozzle Non-linear structural analyses are performed using finite element techniques to study the failure mode of the two tests. Actual test geometry and realistic stress strain data for the 304L stainless steel and the weld material are used in the analyses. The finite element models are loaded until failure strains are reached. The failure modes in both tests are shear at the failure points. Based on these observations, it is concluded that the use of a burst test in lieu of the shear test for qualifying the canister-plug weld is acceptable. The burst test analysis for the canister-plug also yields the burst pressures which compare favorably with the actual pressure found during burst tests. Thus, the analysis also provides an estimate of the safety margins in the design of these vessels.

21792 (WSRC-TR–94-0606) **Inductive Double-Contingency Analysis of UO2 Powder Bulk Blending Operations at a Commercial Fuel Plant (U).** Skiles, S. K. (Westinghouse Savannah River Company, Aiken, SC (United States)). Westinghouse Savannah River Co., Aiken, SC (United States). 22 Dec 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9509100–1: 5. international conference on nuclear criticality safety, Albuquerque, NM (United States), 17-22 Sep 1995). Order Number DE95060144. Source: OSTI; NTIS; INIS; GPO Dep.

An inductive double-contingency analysis (DCA) method developed by the criticality safety function at the Savannah River Site, was applied in Criticality Safety Evaluations (CSEs) of five major plant process systems at the Westinghouse Electric Corporation's Commercial Nuclear Fuel Manufacturing Plant in Columbia, South Carolina (WEC-Cola.). The method emphasizes a thorough evaluation of the controls intended to provide barriers against criticality for postulated initiating events, and has been demonstrated effective at identifying common mode failure potential and interdependence among multiple controls. A description of the method and an example of its application is provided.

21793 (WSRC-TR–95-0157) **Shielded Cells D&D and Dismantlement System Requirements.** Witherspoon, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). 27 Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060139. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the basis for the development of the System for Highly Radioactive Equipment Dismantlement or SHRED. It is the result of a thorough investigation into current and past dismantlement practices at shielded cell facilities around the DOE complex. This information has been used to formulate the development requirements for the SHRED.

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Refer also to citation(s) 20537, 20583, 21299, 21454, 21592, 22134, 22913

21794 (ANL/IFR/CP–85915) **Quantitative characterizations of phasic structure developments by local measurement methods in two-phase flow.** Eberle, C.S. (Argonne National Lab., IL (United States)); Leung, W.H.; Wu, Q.; Ueno, T.; Ishii, M. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950445–3: 2. international conference on multiphase flow, Kyoto (Japan), 3-7 Apr 1995). Order Number DE95012920. Source: OSTI; NTIS; GPO Dep.

An experimental study on the internal structure an a out in a 25.4 mm ID pipe. The local void fraction and interfacial area concentration were measured by a double-sensor probe. The flow structure development was visualized by measuring the radial distribution of these two parameters at three axial, locations (L/D = 12, 62, and 112). A more detailed study on the fully developed flow structure was conducted at L/D = 120. The interfacial structure were measured by the double- and four-sensor probes. A bubbly to-=slug transition region was defined according to the local data.The area-averaged void fraction measurements were given by a gamma densitometer. Other parameters such as the Taylor bubble film thickness, bubble length and slug unit length in slug flow were measured by a film robe. The redundant measurements were made to calibrate the local probe measurements. The quantitative representation of the phasic structure can then be used for modeling.

21795 (DLR-FB–94-22) **Analysis and modeling of small-scale turbulence in the near-wall region of turbulent shear flows.** Jimenez-Haertel, C. (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Goettingen (Germany). Inst. fuer Stroemungsmechanik). Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany). Abt. Operative Planung; Technische Univ. Muenchen (Germany). Fakultaet fuer Maschinenwesen. 1994. 145p. (In German). Order Number DE95779814. Source: OSTI; NTIS (US Sales Only).

The physical characteristics of small-scale turbulence and its energetic interaction with large-scale turbulence are analyzed in flow fields near solid walls. The analysis is based on results obtained from direct numerical simulations of turbulent channel and pipe flow. A key observation is that within the buffer-layer a reverse cascade of turbulent kinetic energy exists in the mean. Here large-scale turbulence structures are fed by nonlinear interactions with small-scale turbulence. The application of the VISA conditional sampling technique reveals that the reverse cascade of energy is closely related to the occurrence of coherent motions in the near-wall flow. It is shown that subgrid-scale models, currently applied in large-eddy simulations, are not capable of accounting for this important phenomenon. The implications of this deficiency for the large-eddy simulation of near-wall turbulence are examined by analyzing results from a series of large-eddy simulations of turbulent channel flow at various Reynolds numbers. (orig.)

21796 (ETDE-DE–125) **Investigation of heat transfer during evaporation and condensation of new, environmentally harmless refrigerants on tube bundles.** Hage, M.; Kriegsmann, A. Wieland-Werke AG, Ulm (Germany). Mar 1993. 27p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie,

Bonn (Germany). Foerderkennzeichen BMFT 01ZH89E1. Order Number DE95780379. Source: OSTI; NTIS (US Sales Only).

In the scope of the 4 th workshop "cogeneration systems" in Berlin a report was given on the present state of cogeneration system technology and application. In addition to questions of financing and organizational-technical aspects, a series of applications was presented. Subject: support, financing through banks, operator models, procedures for approval, conditions for connection regarding gas and electric power, energy policy, cogeneration systems in Berlin, double electric power yield for natural gas relief, electric power from biogas, nuclear power plants, energy supply of a hospital with cogeneration systems. All 12 lectures have been recorded as separate entries in this database. (BWI). 3 refs., 2 tabs., 14 figs.

21797 (ETDE-DE–134) **Simulation model of cooling load for non-steady state behaviour of cooling and freezing processes.** Nowotnick, M. Institut fuer Luft- und Kaeltetechnik GmbH, Dresden (Germany). 24 Apr 1991. 23p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 30E200904. (KB–24/1264/91). Order Number DE95786089. Source: OSTI; NTIS (US Sales Only).

In the context of a wide research programme, a universal cooling load model is to be developed, by which the time course of cooling and freezing processes can be calculated. This programme contains the calculation of one-dimensional non-steady state thermal conduction in a flat plate with phase change and the calculation of drying losses when cooling and freezing halves of pigs. It is intended to generalise the equations for the non-steady state cooling load model and to couple them with the TLK refrigeration plant model. The first stage of working contains the production of a program which can run, whose results are compared with those of further steps of processing. (BWI)

21798 (ETDE-DE–136) **The dynamic behaviour of refrigeration technique systems (basic research). Final report.** Nowotnick, M. Institut fuer Luft- und Kaeltetechnik GmbH, Dresden (Germany). 24 Apr 1991. 6p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 30E2009. (KB–24/1265/91). Order Number DE95786090. Source: OSTI; NTIS (US Sales Only).

In the context of this work, a suitable cooling load model is to be developed, by which the time course of temperature and phase changes in the material being cooled can be simulated. The present part of the report deals with aspects of basic research. In this context, it deals with the pre-conditions, planning and course, the scientific/technical state, the result and the report on its success. (BWI)

21799 (FEI–2378) **Numerical investigation of flows and heat exchange in tubes with use of (k-ε) turbulence model.** Veremeev, A.A.; Leonchuk, M.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 31p. (In Russian). Order Number DE95633491. Source: OSTI; NTIS (US Sales Only); INIS.

A numerical method and program to calculate velocity and temperature distributions in straight channels of arbitrary cross section were developed and tested. They are designed for the numerical investigations of operating conditions of heat exchanging elements of nuclear power plants. The Reynolds-averaged three-dimensional thermal-hydraulic equations and the equations of (k-ε)-model of turbulence are solved by the finite difference technique using orthogonal curvilinear grid. Test calculations were performed for stabilized and non-stabilized flow and heat transfer in round pipes at a wide range of Reynolds numbers for different Prandtl number liquids. Results are well compared with experimental data and empirical correlations. 30 refs.; 18 figs.

21800 (INIS-JP–028, pp. 40-42) **A behavior of helium gas bubble in NaK-78 pool with a magnetic field.** Takahashi, Osamu (Kyoto Univ. (Japan). Faculty of Engineering); Inaba, Takeo; Kohno, Masuchika; Kawara, Zensaku; Serizawa, Akimi. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

In this study we observed a helium-liquid metal (NaK-78) two-phase flow in a pool with and without magnetic field. We measured velocity and drag coefficient of rising bubbles from video images taken by X-ray method. (author).

21801 (INIS-JP–028, pp. 43-44) **Development of a new ultrasonic technique for measuring dynamic behavior of liquid film flow.** Nagane, Kohei (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

This report is concerned with developing a new technique to measure dynamics behaviors of liquid film flowing over a plate or in a channel based on ultrasonic echo method. This new method enables us to obtain one image every 10 msec. (author).

21802 (INIS-JP–028, pp. 45-47) **Dependence of void distribution in bubbly flow on rod arrays inclination angle.** Huda, K. (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

Observations of void distribution were performed to study the characteristics of bubbly flow through inclined rod arrays. Air bubbles were flowing vertically upward through rod arrays for a range of flow rates from 0.01 l/min to 1.5 l/min. The inclination angles of the rods relative to the horizontal were 30deg, 45deg, 60deg and 75deg. The experiments reveal a strong dependence of the inclination angles of the rods. (author).

21803 (INIS-JP–028, pp. 48-50) **Effect of ultrasonic waves on boiling heat transfer.** Mukai, Masakatsu (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku; Mishima, Kaichirou. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

This report focuses on a better understanding of the physical phenomenon related to the enhancement of boiling and non-boiling heat transfer by applying ultrasonic waves. Experimental results obtained both in a pool of water and in a vertically upward water flow proved clearly that macroscopic acoustic stream induced by ultrasonics is a major contribution to heat transfer augmentation. (author).

21804 (INIS-JP–028, pp. 51-53) **Analyses of liquid-gas two-phase flow in fermentation tanks.** Toi, Takashi (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku; Gofuku, Akio; Kataoka, Isao. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University.* Order Number DE95709897. Source: OSTI; NTIS; INIS.

The understanding of two-phase flow is one of the important problems for both design and safety analyses of various engineering systems. For example, the flow conditions in beer fermentation tanks have an influence on the quality of production and productivity of tank. In this study, a two-dimensional numerical calculation code based on the one-pressure two-fluid model is developed to understand the circulation structure of low quality liquid-gas two-phase flows induced by bubble plume in a tank. (author).

21805 (INIS-JP–029, pp. 34-37) **Phase distribution of air-water two-phase flow across inclined tube bundle.** Huda, K. (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku; Kataoka, Isao. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

In order to clarify the mechanisms governing the two-phase external flow structure across the inverted U-tube bundle in a PWR steam generator, measurements of local void fraction and bubble impaction rate have been conducted in a vertical air-water flow across inclined tube bundles. The in-line and staggered 9x6 tube bundles with transverse pitch-to-diameter ratio 2.0 and longitudinal ratio 2.5 were used in the present work. It has been drawn from the present work that the phase distribution in inclined tube bundle is strongly affected by both mass velocity and the inclination angle of the tube bundle. The effect of inclination angle becomes more remarkable at lower mass velocity. (author).

21806 (INIS-JP–029, pp. 38-41) **Measuring method of liquid flow behavior using visualization.** Serizawa, Akimi (Kyoto Univ. (Japan). Faculty of Engineering); Kamei, Takashi; Takahashi, Osamu; Kawara, Zensaku. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

It is important for the safety of nuclear reactor to understand the behavior of gas-liquid two-phase flow. For that analysis, we have to understand its time and spatial dependence. But most of the measuring methods applied to two-phase flow experiments are not enough for this purpose, because they consider the time averaged value, and they are put on the local position in test sections. Standing on such a point of view, we have been developing a measuring method using fluorescence. And from those pictures gotten by video camera, after processed by computer, we measure liquid film thickness. (author).

21807 (INIS-JP–029, pp. 42-44) **Visualization of physical informations derived from numerical calculation.** Kodama, Shigeo (Kyoto Univ. (Japan). Faculty of Engineering); Serizawa, Akimi; Takahashi, Osamu; Kawara, Zensaku. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

It is important for the field of flow dynamics to visualize a flow in some way. In this study, by making use of the result of numerical calculation based on the one-pressure two-fluid model, visualization of some physical informations are developed to understand the characteristics of liquid-gas two phase flow induced by bubble plume in a tank. (author).

21808 (LA–12671-MS) **Two-point correlation equations for variable density turbulence.** Clark, T.T. (Los Alamos National Lab., NM (United States)); Spitz, P.B. Los Alamos National Lab., NM (United States). Jun 1995. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011855. Source: OSTI; NTIS; GPO Dep.

A complete set of two-point correlation equations for variable-density turbulence is derived to consistent order in mass-weighted variables (Favre averaging). The derivation is based on a two-point generalization of the Reynolds stress tensor. The equations are transformed with respect to the separation between the two points to Fourier space. The correlation equations, as well as the Fourier-transformed equations, provide insights that are unavailable in the one-point equations. The derivation of spectral closures is significantly more complicated than that of constant-density closures or one-point variable-density closures due to the complex nature of isotropic scalar-vector correlation functions for nonsolenoidal fields. Several necessary constraints for the correlation functions are presented. In addition, a simple spectral model that satisfies these constraints is presented for illustrative purposes, and a discussion of the two-point correlations and their relationship to the corresponding correlations arising in one-point derivations is provided.

21809 (LA-SUB–94-168) **Computational and experimental studies of hydrodynamic instabilities and turbulent mixing: Review of VNIIEF efforts. Summary report.** Andronov, V.A. (Russian Federal Nuclear Center (Russian Federation)); Zhidov, I.G.; Meskov, E.E.; Nevmerzhitskii, N.V.; Nikiforov, V.V.; Razin, A.N.; Rogatchev, V.G.; Tolshmyakov, A.I.; Yanilkin, Y.V. Los Alamos National Lab., NM (United States); Russian Federal Nuclear Center (Russian Federation). 1994. 213p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011637. Source: OSTI; NTIS; GPO Dep.

The report presents the basic results of some calculations, theoretical and experimental efforts in the study of Rayleigh-Taylor, Kelvin-Helmholtz, Richtmyer-Meshkov instabilities and the turbulent mixing which is caused by their evolution. Since the late forties the VNIIEF has been conducting these investigations. This report is based on the data which were published in different times in Russian and foreign journals. The first part of the report deals with calculations an theoretical techniques for the description of hydrodynamic instabilities applied currently, as well as with the results of several individual problems and their comparison with the experiment. These methods can be divided into two types: direct numerical simulation methods and phenomenological methods. The first type includes the regular 2D and 3D gasdynamical techniques as well as the techniques based on small perturbation approximation and on incompressible liquid approximation. The second type comprises the techniques based on various phenomenological turbulence models. The second part of the report describes the experimental methods and cites the experimental results of Rayleigh-Taylor and Richtmyer-Meskov instability studies as well as of turbulent mixing. The applied methods were based on thin-film gaseous models, on jelly models and liquid layer models. The research was done for plane and cylindrical geometries. As drivers, the shock tubes of different designs were used as well as gaseous explosive mixtures, compressed air and electric wire explosions. The experimental results were applied in calculational-theoretical technique calibrations. The authors did not aim at covering all VNIIEF research done in this field of science. To a great extent the choice of the material depended on the personal contribution of the author in these studies.

21810 (LA-UR–95-1145) **A comparison of interface tracking methods.** Kothe, D.B.; Rider, W.J. Los Alamos National Lab., NM (United States). 27 Mar 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950634–1: 26. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference, San Diego, CA (United States), 19-22 Jun 1995). Order Number DE95009481. Source: OSTI; NTIS; INIS; GPO Dep.

In this Paper we provide a direct comparison of several important algorithms designed to track fluid interfaces. In the process we propose improved criteria by which these methods are to be judged. We compare and contrast the behavior of the following interface tracking methods: high order monotone capturing schemes, level set methods, volume-of-fluid (VOF) methods, and particle-based (particle-in-cell, or PIC) methods. We compare these methods by first applying a set of standard test problems, then by applying a new set of enhanced problems designed to expose the limitations and weaknesses of each method. We find that the properties of these methods are not adequately assessed until they axe tested with flows having spatial and temporal vorticity gradients. Our results indicate that the particle-based methods are easily the most accurate of those tested. Their practical use, however, is often hampered by their memory and CPU requirements. Particle-based methods employing particles only along interfaces also have difficulty dealing with gross topology changes. Full PIC methods, on the other hand, do not in general have topology restrictions. Following the particle-based methods are VOF volume tracking methods, which are reasonably accurate, physically based, robust, low in cost, and relatively easy to implement. Recent enhancements to the VOF methods using multidimensional interface reconstruction and improved advection provide excellent results on a wide range of test problems.

21811 (LBL–36944) **On the development of MP-TOUGH2.** Oldenburg, C.M.; Hinkins, R.L.; Moridis, G.J.; Pruess, K. Lawrence Berkeley Lab., CA (United States). Feb 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9503116–8: 1995 TOUGH workshop, Berkeley, CA (United States), 20-22 Mar 1995). Order Number DE95012328. Source: OSTI; NTIS; GPO Dep.

The authors are developing MP-TOUGH2 for exploiting massively parallel computers. The goals of this effort are to (1) create

a data-parallel subsurface transport code for solving larger problems than currently practical on workstations, (2) write portable code that can take advantage of scalability to run on machines with more processors, and (3) minimize the necessity for additional validation and verification of the resulting code. The initial strategy they have followed is to focus on optimizing the generic and time-consuming task of linear equation solution while leaving the bulk of TOUGH2 unmodified. In so doing, they have implemented a massively parallel direct solver (MPDS) that takes advantage of the banded structure of TOUGH2 Jacobian matrices. The authors have compared timings of the iterative conjugate gradient solvers DSLUBC, DSLUCS, and DSLUGM written in Fortran77 for the front end with the MPDS which uses the data parallel unit. The MPDS shows good performance relative to the iterative conjugate gradient solvers on the free-convection test problem. The robust direct solution provided by MPDS can be used to (1) check on the veracity of a given iterative conjugate gradient solution, or (2) be used on certain problems where iterative solvers fail to converge. The test problem used in this study is the Elder pure thermal convection problem. For generality, the authors use the TOUGH2 equation of state module EOS3 for water, air, and heat, although this particular problem is a single-phase flow problem.

21812 (LBL–37066) **A new set of direct and iterative solvers for the TOUGH2 family of codes.** Moridis, G.J. (Lawrence Berkeley Lab., CA (United States). Earth Sciences Div.). Lawrence Berkeley Lab., CA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9503116–10: 1995 TOUGH workshop, Berkeley, CA (United States), 20-22 Mar 1995). Order Number DE95012332. Source: OSTI; NTIS; INIS; GPO Dep.

Two new solvers are discussed. LUBAND, the first routine is a direct solver for banded systems and is based on a LU decomposition with partial pivoting and row interchange. BCGSTB, the second routine, is a Preconditioned Conjugate Gradient (PCG) solver with improved speed and convergence characteristics. Bandwidth minimization and gridblock ordering schemes are also introduced into TOUGH2 to improve speed and accuracy. TOUGH2 simulates fluid and heat flows in permeable media and is used for the evaluation of WIPP and TEVES (Thermal Enhanced Vapor Extraction System) that will be used to extract solvents from the Chemical Waste Landfill at Sandia National Laboratories.

21813 (LUTMDN-TMVK–3171) **Effects of cycling frequency on heat transfer in domestic gas boilers.** Naeslund, M. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Mar 1995. 27p. Order Number DE95779299. Source: OSTI; NTIS.

A heat transfer model for domestic gas boilers in transient operation is derived in the report. Three heat capacities are used in the model, the heat exchanger, the radiator water and the flue gases. Steady state performance is used to characterize heat exchanger areas and heat transfer coefficients. Calculations are made in order to evaluate the effects of changes in the burner operating frequency. Comparisons with measurements show good agreement and explanations to measured boiler characteristics are given. 5 refs, 14 figs, 6 tabs

21814 (LUTMDN-TMVK–7018) **Laser doppler measurements of turbulent swirling flows in a circular tube with a sudden expansion followed by a sudden contraction.** Wessman, M. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Feb 1995. 47p. Order Number DE95779303. Source: OSTI; NTIS.

Two component Laser Doppler Velocimetry measurements have been made in a turbulent flow field in an axisymmetric confined sudden expansion, followed by a contraction. Measurements were made using different inlet swirl numbers and Reynolds numbers. One flow field with reduced distance between the expansion and the contraction was also studied. The investigated geometry can be seen as a simplified gas turbine combustor, where the swirl is introduced to increase the mixing rate and stabilize the flame. When the swirl is introduced, the turbulent energy increases, and when the swirl number reaches a value between 0.33 and 0.43 a central recirculation zone occurs, which increases with increasing swirl number. For higher swirl numbers the central recirculation zone has a hollow core shape. To characterize the influence of the periodic disturbances that are associated with swirling flows, an integration of an estimated power spectrum around the frequency of the periodic disturbances was made. It was found that as much as 50% of the turbulent kinetic energy is associated with the periodic disturbances. The measurements include mean velocities and Reynolds stresses, which provide a data base suitable for model validation. 36 refs, 47 figs, 7 tabs

21815 (LUTMDN-TMVK–7019) **Simulation of flowmeter installation effects.** Holm, M. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Mar 1995. 33p. Order Number DE95779304. Source: OSTI; NTIS.

Determination of the calibration factor for an ultrasonic flow meter subjected to an installation effect has been made with the aid of Computational Fluid Dynamics. Validation of the method has been done by comparing computed and measured calibration factors for a 100 diameter straight tube, a single elbow and a double elbow out of plane bend. The Reynolds number was varied from 2,000 to 12,000 for all cases and extended to 100,000 for the 100 diameter straight tube. The agreement between simulated and measured data are within +/- 1 per cent for the tested cases. Above Reynolds number 30,000 the agreement are well below 1 per cent error. 51 refs, 15 figs, 8 tabs

21816 (SAND–94-2471C) **Computational fluid dynamic studies of a solid and ribbon 12-gore parachute canopy in subsonic and supersonic flow.** Nelsen, J.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950550–4: 13. aerodynamics decelerator systems technology conference, Clearwater, FL (United States), 15-19 May 1995). Order Number DE95012236. Source: OSTI; NTIS; GPO Dep.

Computational fluid dynamic studies of 3-D, fixed geometry, gore-shaped parachute canopies are presented. Both solid and ribbon canopies with a 10% vent diameter are investigated. The flowfields analyzed are laminar and compressible, broaching both the subsonic and supersonic regimes. Results presented include characterization of the local and global flowfields and the internal and external canopy surface pressure distributions. The canopy surface pressure distributions may be utilized in subsequent structural analyses to assess the integrity of the parachute canopy fabric components.

21817 (SAND–95-0750C) **Evaluation of conductive, radiative, chemical, and convective heat transfer in complex systems using a fast-running, implicit, lumped-capacitance formulation.** Benjamin, A.S.; Beraun, R.; Brown, N.N.; Sherman, M.P. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950828–9: National heat transfer conference, Portland, OR (United States), 5-9 Aug 1995). Order Number DE95011889. Source: OSTI; NTIS; GPO Dep.

Accurate finite-element simulation of 3-D nonlinear heat transfer in complex systems may require meshes composed of tens of thousands of finite elements and hours of CPU time on today's fastest computers. To treat applications in which thousands of calculations may be necessary such as for risk assessment or design of high-temperature manufacturing processes, methods are needed which can solve these problems far more efficiently and maintain an acceptably high degree of accuracy. For this purpose, we developed the Thermal Evaluation and Matching Program for Risk Applications (TEMPRA). The primary differentiator between TEMPRA and comparable codes is its numerical formulation, which is designed to be unconditionally stable even with very large time steps, to afford good accuracy even with relatively coarse meshing, and to facilitate benchmarking/calibration through the use of adjustable parameters. Analysis for a sample problem shows that TEMPRA can obtain temperature response solutions with errors of less than 10% using approximately 1/1000 of the computer time required by a typical finite element code.

21818 (SAND–95-0829C) **Simulations of hydrodynamic interactions among immersed particles in stokes flow using a massively parallel computer.** Ingber, M.S. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Mechanical Engineering);

Womble, D.E.; Mondy, L.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507125–1: BEM 17: Boundary element methods, Madison, WI (United States), 17-19 Jul 1995). Order Number DE95011891. Source: OSTI; NTIS; GPO Dep.

In this paper, a massively parallel implementation of the boundary element method to study particle transport in Stokes flow is discussed. The numerical algorithm couples the quasistatic Stokes equations for the fluid with kinematic and equilibrium equations for the particles. The formation and assembly of the discretized boundary element equations is based on the torus-wrap mapping as opposed to the more traditional row- or column-wrap mappings. The equation set is solved using a block Jacobi iteration method. Results are shown for an example application problem, which requires solving a dense system of 6240 equations more than 1200 times.

21819 (WAPD-T–3064) **Piping elbow irrecoverable pressure loss coefficients for moderately high Reynolds numbers.** Coffield, R.D.; Brooks, P.S.; Hammond, R.B. Bettis Atomic Power Lab., West Mifflin, PA (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-93PN38195. (CONF-950965–1: ASME fluids engineering summer meeting, Hilton Head, SC (United States), 13-18 Sep 1995). Order Number DE95003873. Source: OSTI; NTIS; INIS; GPO Dep.

Test data is described for three different piping elbows. These include 900 elbows with radii of curvature of 1 2 and 1.5, and a 45° elbow with a radius of curvature of 1.2. These radii of curvature are sufficiently sharp to cause significant irrecoverable pressure losses to occur. The variation in static wall pressure was measured upstream and downstream of each elbow plus spatially around the elbow itself. Irrecoverable loss coefficients over a range of flows were obtained and correlations for the data are provided. The testing extended the Reynolds number range of the currently existing data base in various handbooks (and other references available in the open literature) by over a factor of five. Comparisons of results to predictions from the correlations of prior studies are provided.

4205 Materials Testing

Refer also to citation(s) 21850, 22031

21820 (CEA-CONF–12001) **CIVA workstation for NDE: mixing of NDE techniques and modeling.** Benoist, P. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Procedes et Systemes Avances); Besnard, R.; Bayon, G.; Boutaine, J.L. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Procedes et Systemes Avances. 1994. 8p. (CONF-9407185–: Conference on Quantitative Non Destructive Evaluation, Denver, CO (United States), 31 Jul - 5 aug 1994). Order Number DE95631334. Source: OSTI; NTIS (US Sales Only); INIS.

In order to compare the capabilities of different NDE techniques, or to use complementary inspection methods, the same components are examined with different procedures. It is then very useful to have a single evaluation tool allowing direct comparison of the methods: CIVA is an open system for processing NDE data; it is adapted to a standard work station (UNIX, C, MOTIF) and can read different supports on which the digitized data are stored. It includes a large library of signal and image processing methods accessible and adapted to NDE data (filtering, deconvolution, 2D and 3D spatial correlations...). Different CIVA application examples are described: brazing inspection (neutronography, ultrasonic), tube inspection (eddy current, ultrasonic), aluminium welds examination (UT and radiography). Modelling and experimental results are compared. 16 fig., 7 ref.

21821 (CONF-9509118–2) **Massively parallel simulation of welding processes.** Zacharia, T.; Simunovid, S. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Modeling of casting, welding and advanced solidification processes 7; London (United Kingdom); 10-15 Sep 1995. Order Number DE95010221. Source: OSTI; NTIS; GPO Dep.

A computer program for three-dimensional transient analyses of welding processes has been modified for use on massively parallel computers. The computational model is based on a discrete element method that takes into account geometric variations of an object, heat transfer, fluid flow, deformable free surface, solid/liquid interface, buoyancy, electromagnetic and surface forces acting on a weld. The microstructure evolution during welding is simulated using the Monte Carlo technique based on the results obtained from the macroscopic discrete element analysis.

21822 (SAND–95-8530C) **Establishing multiaxial testing capabilities for tubular and planar specimens.** Brandon, S.L.; Korellis, J.S.; Kawahara, A. Sandia National Labs., Livermore, CA (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950569–1: 6. ASTM symposium on composites: fatigue and fracture, Denver, CO (United States), 16-18 May 1995). Order Number DE95010757. Source: OSTI; NTIS; GPO Dep.

Because of the desire to improve accuracy of plasticity models under multiaxial stress/strain states, and the need to test orthotropic materials such as composites, Sandia/CA developed two separate digitally-controlled materials testing systems. One is for Axial/Torsional/Pressure testing of tubular specimens instrumented with either strain gages (small strains) or a multiaxial extensometer (large strain). System capacity is 440kN (100,000pounds) axial plus 6kN-m (50,000inch-pounds) torsion plus 200MPa (30,000psi) internal pressure. The other is a planar biaxial system with 2MN (500,000pounds) capacity for testing composites and metals, with provisions for 1MN (250,000 pounds) in a third orthogonal axis for testing of pressure-sensitive materials and geomaterials.

21823 (STUK-YTO-TR–47) **Performance demonstration and personnel qualification for ultrasonic examination in service inspection of nuclear power plants.** Sillanpaeae, J.; Saerkiniemi, P. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Feb 1993. 50p. (In Finnish). Order Number DE95632432. Source: OSTI; NTIS; INIS.

The ASME Code section XI (App. VII and VIII) requires that ultrasonic examination procedures, equipment and personnel used to detect and size flaws in reactor vessels, piping welds, bolts and studs shall be qualified by performance demonstration. The requirements for the qualifications of ultrasonic testing personnel and also the requirements for specimens, rules for the conduct of performance demonstrations and acceptance criteria have been clarified in this report. The preparation for these requirements is in progress and the situation in different countries e.g. US and England has been discussed. Also the possibilities to fulfill the requirements of Appendix VIII in Finland are dealt with. (29 refs., 7 figs., 5 tabs.).

21824 (UCRL-JC–118241) **Advanced ground penetrating radar.** Warhus, J.P. (Lawrence Livermore National Lab., CA (United States). Electronics Engineering Dept.); Mast, J.E.; Johansson, E.M.; Nelson, S.D. Lawrence Livermore National Lab., CA (United States). 26 Jul 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940723–42: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE95012480. Source: OSTI; NTIS; GPO Dep.

An advanced Ground Penetrating Radar (GPR) system has the potential for efficiently and reliably providing high resolution images for inspecting concrete civil structures for defects and damage assessment. To achieve the required performance, improvements in radar hardware, and development and adaptation of advanced 2- and 3-dimensional synthetic aperture imaging techniques are needed. Recent and continuing advancement in computer and computer-related technology areas have made it possible to consider more complex and capable systems for a variety of imaging applications not previously conceived. The authors developed conceptual designs, analyzed system requirements, and performed experiments, modeling, and image reconstructions to study the feasibility of improving GPR technology for non-destructive evaluation of bridge decks and other high-value concrete structures. An overview and summary of practical system concepts and requirements, are presented.

21825 (UCRL-JC–120505) **Overview of nondestructive evaluation technologies.** Thomas, G. Lawrence Livermore National Lab., CA (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506126–4: Conference on nondestructive evaluation of aging infrastructure, Oakland, CA (United States), 6-8 Jun 1995). Order Number DE95011444. Source: OSTI; NTIS; GPO Dep.

The infrastructure in the US and the world is aging. There is an increasing awareness of the need to assess the severity of the damage occurring to the infrastructure. Limited resources preclude the replacement of all structures that need repairs or have exceeded their life times. Methods to assess the amount and severity of damage are crucial to implementing a systematic, cost effective approach to repair and/or replace the damaged structures. The challenges of inspecting aging structures without impairing their usefulness rely on a variety of technologies and techniques for nondestructive evaluation (NDE). This paper will briefly describe several nondestructive evaluation technologies that are required for inspecting a variety of systems and structures.

4210 Combustion Systems

Refer also to citation(s) 20529, 20588, 20589, 20590, 20725

21826 (ANL/ET/CP–85778) **Computer modeling of radiation and combustion in a rotary solid-waste incinerator.** Chang, F.C. (Argonne National Lab., IL (United States)); Rhodes, C.A. Argonne National Lab., IL (United States); South Carolina Univ., Columbia, SC (United States). Dept. of Mechanical Engineering. [1995]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–62: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014236. Source: OSTI; NTIS; GPO Dep.

A mathematical model was developed to study the effect of the various particulates that occur in pulverized-coal flames of solid-waste incinerators. Radiation heat transfer between refractory surface and flame, transient conditions in the refractory, and chemical reactions in the waste material is included in the model. Radiation heat exchange is determined by the absorption factor technique. A first-order-chemical-reaction rate is assumed for the solid waste. This study takes into account the radiation emission, absorption, and scattering of gaseous media for water vapor and carbon dioxide contained in the combustion gases. Soot particles are also investigated. The variables are mass fraction, particle size, complex refractive index, and amount of solid waste. Rayleigh scattering is assumed for particles. Refractory-wall temperature variations, surface temperature of the refractory, solid-waste temperature, and solid-waste flow rates was investigated. This study is important for design purposes in determining the length of the incinerator required to completely burn the wastes.

21827 (DOE/CE/41003–T1) **CFCC radiant burner assessment. Final report, April 1, 1992–July 31, 1994.** Schweizer, S.; Sullivan, J. Alzeta Corp., Santa Clara, CA (United States). Nov 1994. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-92CE41003. Order Number DE95012908. Source: OSTI; NTIS; GPO Dep.

The objective of this work was to identify methods of improving the performance of gas-fired radiant burners through the use of Continuous Fiber Ceramic Composites (CFCCs). Methods have been identified to improve the price and performance characteristics of the porous surface burner. Results are described.

21828 (ETDE-DE–135) **Development of pressurised fluidised bed combustion technique for coal-fired gas/steam processes.** Pitt, R.; Steven, H. Steinmueller (L.u.C.) GmbH, Gummersbach (Germany); Technische Hochschule Aachen (Germany). Lehrstuhl und Inst. fuer Dampf- und Gasturbinen. 1992. 14p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0326702A. Order Number DE95786082. Source: OSTI; NTIS (US Sales Only).

The investigations for the development of the pressurized fluidized bed technique have shown that it is possible, in principle, to keep within the emission limits with the steady state pressurised fluidised bed combustion, even at low part load. However, the construction expense is considerable and the type of coal and grain size must comply relatively exactly with the design values. Not every fuel is suitable for fluidised bed combustion regarding emission. The most important parameter for emission is the temperature profile for this component, which should be as even as possible at a high temperature level. A sufficient dwell time of the gas and the particles is decisive for CO emission, where a minimum reaction time is required for both phases. (orig.)

21829 (SAND–95-8517C) **Vortical and industrial interactions.** Barr, P.K. (Sandia National Labs., Livermore, CA (United States). Combustion Research Facility). Sandia National Labs., Livermore, CA (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950283–3: Application of vortex methods to engineering problems forum, Albuquerque, NM (United States), 22-24 Feb 1995). Order Number DE95010700. Source: OSTI; NTIS; GPO Dep.

A vortex-dynamics-based model has been developed and used to study the importance of flame extinction by fluid dynamic strain that occurs in a pulse combustor. Results show that flame extinction by fluid dynamic stretch, which occurs during injection of the fresh charge, ensures the correct phase relation between the energy release and the resonant pressure wave. This phasing is required by Rayleigh's criterion for stable combustion-driven oscillations. However, this model also showed that the vortex dynamics technique is not at a stage where design engineers can use it as a predictive tool, just as they would use experimental testing. This is in part because pulse combustor designs being developed today use three-dimensional geometries and complex operating conditions, whereas the vortex model simulates processes occurring only in the combustion chamber, and ignores the rest of the pulse combustor unit. Also, the model assumes two-dimensional flow, a simple combustor geometry, and premixed combustion. A successful in-house manufacturing design code must be able to perform a complete design study reliably, quickly and easily, and on computers that are readily available to industry. Instead, the insight gained from the vortex dynamics model is being incorporated into a computational tool to assist in pulse combustor design. This tool will be used by industrial engineers to design pulse combustors for specific applications. The design tool combines submodels for acoustics, injection and combustion, producing a pulse combustor model that dynamically couples the processes in the combustion chamber to the acoustic waves.

4220 Mining and Underground Engineering

Refer also to citation(s) 20626, 20962

4250 Power Cycles

21830 (LUTMDN-TMVK–5249) **Performance measurement of the Aequitas 2 kW Stirling generating set TRE 60.** Paalsson, Magnus. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. May 1995. 67p. (In Swedish). Order Number DE95779294. Source: OSTI; NTIS.

Examination paper.

In 1989 a developing project was started with the aim of constructing a durable power unit in the 1 kW-class, where the power source consists of a Stirling engine with a diesel burner. The project was initiated by a need for a simple and fairly cheap 1 kW battery charger for 24 volt batteries. This report treat the performance monitoring of a diesel-powered Stirling engine and a permanently magnetized DC-machine in the 2kW-class. Parameters studied are overall efficiency and power output;, efficiency and shaft power of the Stirling engine;, and the connection between pressure, number of revolutions, and torque for the engine. 29 figs, 1 tab, 7 appendices with monitored data

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 21236, 21335, 21401, 21489, 21490, 21670, 21671, 21757, 21944, 21947, 21949, 21954, 22038, 22128, 22932

21831 (CONF-950610–1) **A multilevel voltage-source converter system with balanced dc voltages.** Peng, Fang Zheng (Tennessee Univ., Knoxville, TN (United States)); Lai, Jih-Sheng; McKeever, J.; VanCoevering, J. Oak Ridge National Lab., TN (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Power electronics specialist conference; Atlanta, GA (United States); 12-15 Jun 1995. Order Number DE95009695. Source: OSTI; NTIS; GPO Dep.

A multilevel voltage-source converter system is proposed for high-voltage, high-power applications such as large induction motor drives, back-to-back interconnected power systems, and electrical traction drives. Multilevel voltage-source converters have a voltage unbalance problem in the dc capacitors. The problem may be solved by use of additional voltage regulators or separate dc sources. However, these solutions are found not to be practicable for most applications. The proposed converter system can solve the voltage unbalance problem of the conventional multilevel voltage-source converters, without using any additional voltage balance circuits or separate voltage sources. Mechanism of the voltage unbalance problem is analyzed theoretically in this paper. The validity of the new converter system is demonstrated by simulation and experiment.

21832 (DOE/AL/98817–2) **Flip Chip Attach (TRP ARPA No. 3327). Quarterly report, January 1, 1995–March 31, 1995.** Woychik, C.G. International Business Machines Corp., Endicott, NY (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-94AL98817. Order Number DE95012189. Source: OSTI; NTIS; GPO Dep.

IBM Endicott, Assembly Process Design has continued to progress on the ARPA Contract for Conductive Adhesive Flip Chip Attach during the period January 3, 1995 to March 31, 1995 in defining process bonding parameters. An initial test chip design has been defined and ordered. Insights have been gained about stencil printing. Benchmarking reliability tests of flip chip encapsulants continued as well as studies on the thermal conductivity of the electrically conductive adhesive.

21833 (KCP–613-5537) **Characterization of DuPont 9015, aqueous processable dry film photoresist for printed wiring boards. Topical report.** Goldammer, S. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1995. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE95011239. Source: OSTI; NTIS; GPO Dep.

This report describes the evaluation of DuPont's Riston 9015, fully aqueous processable dry film photoresist as a mask for gold plating, tin/lead plating, and print and etch patterning for printed circuit board products.

21834 (LA-SUB–94-15) **Development of code for modeling the kinetics of xenon atomic lasers. Final report.** Kushner, M.J. (Illinois Univ., Urbana, IL (United States). Dept. of Electrical and Computer Engineering). Los Alamos National Lab., NM (United States); Illinois Univ., Urbana, IL (United States). Dept. of Electrical and Computer Engineering. Dec 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010871. Source: OSTI; NTIS; GPO Dep.

Consists of vugraphs.

21835 (LA-UR–95-1502) **A chirped-pulse regenerative-amplifier FEL for the gamma-gamma collider.** Chan, K.C.D.; Goldstein, J.C.; Nguyen, D.C.; Takeda, H. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–104: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011990. Source: OSTI; NTIS; INIS; GPO Dep.

During a Workshop on Gamma-Gamma Colliders in Lawrence Berkeley Laboratory, it was pointed out that an 1-μm laser that can produce 1-J, 1-ps pulses at a few hundred hertz is required. With high-power scalability and ease of formatting, an FEL can be a promising candidate for such a laser. The authors propose an FEL scheme based on chirped-pulsed regenerative amplification to achieve this high peak-power laser. The 1-ps pulse of a solid-state laser will be stretched, amplified, and recompressed to achieve the high peak power. The system is relatively simple and consists of mostly components that have already been demonstrated. This paper will describe the proposal and the important issues of such a scheme.

21836 (SAND–94-3205C) **An application of mechanical leverage to microactuation.** Sniegowski, J.J. (Sandia National Labs., Albuquerque, NM (United States)); Smith, C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950650–1: 8. international conference on solid-state sensors and actuators and 9th biannual international conference and annual European conference on solid-state sensors, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95011883. Source: OSTI; NTIS; GPO Dep.

Preliminary results on the use of mechanical advantage to convert a short-displacement, high-force actuation mechanism into a long-displacement, medium-force actuator are presented. This micromechanical, mechanically-advantaged actuator is capable of relatively large displacement and force values. The target design values are lever ration of 17.5:1 leading to a $\pm$17.5 μN of force throughout providing no less than 2.25 μN of force throughout actuator's range of motion for an applied voltage of less tan 50 volts. The basis for the mechanical advantage is simple levers with fulcrums.

21837 (SAND–95-0084C) **Ion implantation processing for high-speed GaAs JFETs.** Zolper, J.C.; Baca, A.G.; Sherwin, M.E.; Shul, R.J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950518–11: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013834. Source: OSTI; NTIS; GPO Dep.

GaAs Junction Field Effect Transistors (JFETs) offer a higher gate turn-on voltage, resulting in a better noise margin and reduced power dissipation, than the more widely employed GaAs MESFET. The primary reason the JFET has not been more widely used is the speed penalty associated with the gate/channel junction and corresponding gate length broadening. We present the ion implantation processes used for a self-aligned, all ion-implanted, GaAs JFET that minimizes the speed penalty for the JFET while maintaining the advantageous higher gate turn-on voltage. Process characterization of the p_+-gate implant done with either Mg, Zn, or Cd along with the co-implantation of P is presented. In addition, a novel backside channel confinement technology employing ion-implanted carbon is discussed. Complete JFET device results are reported.

21838 (SAND–95-0794C) **Impurity gettering.** Picraux, S.T. Sandia National Labs., Albuquerque, NM (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505211–1: DOE Council on Materials conference on new directions for ion beams in semiconductor processing, Santa Fe, NM (United States), 4-7 May 1995). Order Number DE95012227. Source: OSTI; NTIS; GPO Dep.

Transition metal impurities are well known to cause detrimental effects when present in the active regions of Si devices. Their presence degrades minority carrier lifetime, provides recombination-generation centers, increases junction leakage current and reduces gate oxide integrity. Thus, gettering processes are used to reduce the available metal impurities from the active region of microelectronic circuits. Gettering processes are usually divided into intrinsic (or internal) and extrinsic (or external) categories. Intrinsic refers to processing the Si wafer in a way to make available internal gettering sites, whereas extrinsic implies externally introduced gettering sites. Special concerns have been raised for intrinsic gettering. Not only will the formation of the precipitated oxide and denuded zone be difficult to achieve with the lower thermal budgets, but another inherent limit may set in. In this or any process which relies on the precipitation of metal silicides the impurity concentration can only

be reduced as low as the solid solubility limit. However, the solubilities of transition metals relative to silicide formation are typically found to be $\gtrsim 10^{12}/cm^3$ at temperatures of 800 C and above, and thus inadequate to getter to the needed concentration levels. It is thus anticipated that future microelectronic device processing will require one or more of the following advances in gettering technology: (1) new and more effective gettering mechanisms; (2) quantitative models of gettering to allow process optimization at low process thermal budgets and metal impurity concentrations, and/or (3) development of front side gettering methods to allow for more efficient gettering close to device regions. These trend-driven needs provide a driving force for qualitatively new approaches to gettering and provide possible new opportunities for the use of ion implantation in microelectronics processing.

21839 (SAND–95-0851C) **Surface micromachined microengine as the driver for micromechanical gears.** Garcia, E.J.; Sniegowski, J.J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950650–2: 8. international conference on solid-state sensors and actuators and 9th biannual international conference and annual European conference on solid-state sensors, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95011881. Source: OSTI; NTIS; GPO Dep.

The transmission of mechanical power is often accomplished through the use of gearing. The recently developed surface micromachined microengine provides us with an actuator which is suitable for driving surface micromachined geared systems. In this paper we will present aspects of the microengine as they relate to the driving of geared mechanisms, issues relating to the design of micro gear mechanisms, and details of a design of a microengine-driven geared shutter mechanism.

21840 (SAND–95-0998C) **Thin film circuit fabrication on diamond substrates for high power applications.** Norwood, D. (Sandia National Labs., Albuquerque, NM (United States)); Worobey, W.; Peterson, D.; Sweet, J.; Johnson, D.; Miller, D.; Andaleon, D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950840–1: International conference on applications of diamond films and related materials, Gaithersburg, MD (United States), 21-24 Aug 1995). Order Number DE95011887. Source: OSTI; NTIS; GPO Dep.

Sandia Laboratories has developed a thin film diamond substrate technology to meet the requirements for high power and high density circuits. Processes were developed to metallize, photopattern, laser process, and, package diamond thin film networks which were later assembled into high power multichip modules (MCMS) to test for effectiveness at removing heat. Diamond clearly demonstrated improvement in heat transfer during 20 Watt, strip heating experiments with junction-to-ambient temperature increases of less than 24 C compared to 126 C and 265 C for the aluminum nitride and ceramic versions, respectively.

21841 (SAND–95-1108C) **GaAs integrated circuit process characterization and non-destructive process monitoring by atomic force microscopy.** Baca, A.G.; Howard, A.J.; Shul, R.J.; Zolper, J.C.; Rieger, D.J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950518–5: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013033. Source: OSTI; NTIS; GPO Dep.

We report a new application of atomic force microscopy (AFM) for process characterization of GaAs integrated circuit fabrication. By using the near atomic-level z-resolution of AFM, we are able to gain information not available by other imaging techniques in a number of steps in the sequence for GaAs IC fabrication. A nondestructive method of determining whether micron-sized vias have been etched to completion is presented. In addition, the AFM has been used to evaluate material removal following several of fabrication steps. Shallow trench formation occurs as a result of GaAs removal during the sidewall etch for a commonly used sidewall spacer process. This effect has been not been observed previously by other techniques. Other examples of unintentional removal of small amounts of GaAs during shallow wet and dry etches are presented. These examples show the utility of AFM as an in-line process characterization tool.

21842 (SAND–95-1193C) **Tuning a double quantum well Fermi surface with in-plane magnetic fields.** Simmons, J.A.; Harff, N.E.; Eiles, T.M.; Lyo, S.K.; Klem, J.F. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950820–2: 11. international conference on the electronic properties of two dimensional systems, Nottingham (United Kingdom), 7-11 Aug 1995). Order Number DE95013867. Source: OSTI; NTIS; GPO Dep.

A double quantum well (QW) subject to in-plane magnetic fields $B_{||}$ has the dispersion curves of its two QWs shifted in k-space. When the QWs are strongly coupled, an anticrossing and partial energy gap occur, yielding a tunable multi-component Fermi surface. We report measurements of the resultant features in the conductance, capacitive density of states, and giant deviations in cyclotron effective masses.

21843 (SAND–95-8512C) **Time-dependent intensity and phase measurements of ultrashort laser pulses as short as 10 fs.** DeLong, K.W. (Sandia National Labs., Livermore, CA (United States)); Fittinghoff, D.N.; Ladera, C.L.; Trebino, R.; Taft, G.; Rundquist, A.; Murnane, M.M.; Kapteyn, H.C.; Christov, I.P. Sandia National Labs., Livermore, CA (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507122–1: CLEO/Pacific Rim coal conference, Makuhar (Japan), 11-14 Jul 1995). Order Number DE95010915. Source: OSTI; NTIS; INIS; GPO Dep.

Frequency-Resolved Optical Gating (FROG) measures the time-dependent intensity and phase of an ultrashort laser pulse. Using FROG, we have tested theories for the operation of sub–10 fs laser oscillators.

21844 (SLAC-PUB–95-6885) **High-field strong-focusing undulator designs for X-ray Linac Coherent Light Source (LCLS) applications.** Caspi, S. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Schlueter, R.; Tatchyn, R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (LBL–37216; CONF-950512–100: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95010744. Source: OSTI; NTIS; INIS; GPO Dep.

Linac-driven X-Ray Free Electron Lasers (e.g., Linac Coherent Light Sources (LCLSs)), operating on the principle of single-pass saturation in the Self-Amplified Spontaneous Emission (SASE) regime typically require multi-GeV beam energies and undulator lengths in excess of tens of meters to attain sufficient gain in the 1Å–0.1Å range. In this parameter regime, the undulator structure must provide: (1) field amplitudes B_0 in excess of 1T within periods of 4cm or less, (2) peak on-axis focusing gradients on the order of 30T/m, and (3) field quality in the 0.1%–0.3% range. In this paper the authors report on designs under consideration for a 4.5–1.5 Å LCLS based on superconducting (SC), hybrid/PM, and pulsed-Cu technologies.

21845 (UCRL-CR–112910-2) **Discrete modeling of optical pulse propagation in nonlinear media. Final report.** Ziolkowski, R.W. (Univ. of Arizona, Tucson, AZ (United States). Dept. of Electrical and Computer Engineering). Lawrence Livermore National Lab., CA (United States); Arizona Univ., Tucson, AZ (United States). Engineering Experiment Station. [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011515. Source: OSTI; NTIS; GPO Dep.

With the continuing and heightened interest in nonlinear semiconductor and optically integrated devices, more accurate and realistic numerical simulations of these devices and systems are in demand. Such calculations provide a testbed in which one can investigate new basic and engineering concepts, materials, and device configurations before they are fabricated. This encourages multiple concept and design iterations that result in enhanced performances and system integrations of those devices. They also provide a framework in which one can interpret complex experimental results and suggest further diagnostics or alternate protocols.

Thus the time from device conceptualization to fabrication and testing could be enormously improved with numerical simulations that incorporate more realistic models of the linear and nonlinear material responses and the actual device geometries. The authors have successfully developed a finite difference time domain method that simulates the propagation of ultra-short optical pulses in nonlinear materials which can be described with a linear Lorentz dispersion model, an instantaneous nonlinear Kerr model and a retarded nonlinear Raman model. They have used this NL-FDTD method to model and characterize several ultra-short optical pulse configurations including linear and nonlinear optical waveguides that could be used as all-optical output couplers and beam steerers.

21846 (UCRL-ID–109089-93) **Laser programs highlights 1993.** Lawrence Livermore National Lab., CA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012473. Source: OSTI; NTIS; GPO Dep.

Over the last two decades, the scope of our laser research has grown immensely. The small, low-power laser systems of our early days have given way to laser systems of record-breaking size and power. Now we are focusing our activities within the target physics and laser science programs to support the ignition and gain goals of the proposed glass-laser National Ignition Facility. In our laser isotope separation work, we completed the most important set of experiments in the history of the AVLIS Program in 1993, which culminated in a spectacularly successful run that met or exceeded all our objectives. We are also developing lasers and laser-related technologies for a variety of energy, commercial, and defense uses. On the horizon are transfers of important technologies for waste treatment, x-ray lithography, communications and security, optical imaging, and remote sensing, among others.

21847 (UCRL-ID–118761) **Energy and particle flow in low temperature plasmas.** Bardsley, J.N.; Hewett, D.W.; Vitello, P. Lawrence Livermore National Lab., CA (United States). 16 Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012104. Source: OSTI; NTIS; GPO Dep.

Increased interest in the development of high density plasma sources for ultra large scale integrated circuit manufacturing with varying geometry and power coupling strategies require the development of 2D models for accurate plasma reactor studies. An objective of their research was to develop a computationally efficient numerical code that would be useful as a design tool for inductively coupled plasma reactors. To achieve that goal the authors created a 2D fluid model (INDUCT2D) of an argon discharge. As uniformity is a primary issue in wafer manufacturing they have used INDUCT2D to investigate the effect of pressure and reactor geometry on the spatial uniformity of the etching ion flux. They have found that the optimum pressure for maximum uniformity depends upon the spatial profile of the inductive heating, and decreases with the reactor aspect ratio.

21848 (UCRL-JC–117360) **Temporal dynamics of the multi-frequency spectrum generated by self-phase modulation of two frequencies in single-mode fiber.** Pennington, D.M.; Henesian, M.A.; Brown, C.G.; Danforth, P.M.; Eimerl, D. Lawrence Livermore National Lab., CA (United States). Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941006–6: SPIE annual conference of the Optical Society of America and exhibit, Boston, MA (United States), 30 Oct - 4 nov 1994). Order Number DE95010920. Source: OSTI; NTIS; GPO Dep.

The authors report the development of a tunable bandwidth source based on self-phase modulation of two frequencies in an optical fiber. A single frequency pulse was obtained by placing a 688 μm etalon with finesse = 3.3 in a single mode, single frequency Q-switched ND:YLF oscillator. Angle tuning of the etalon allowed continuous frequency tuning of the oscillator by $\pm$ 2.5 Å about the central frequency of 10,530.3 Å. Two oscillators were modified and tuned to 10,532.8 Å and 10,527.8 Å, respectively. Additional tests performed with a 344 μm etalon allowed tuning of $\pm$5 Å, but with reduced output energy and stability ($\pm$ 20%); however, pulse to pulse energy fluctuations can be compensated for by the use of a pulse energy regulator if a broader range of tunability is required. The output beams were temporally and spatial overlapped, and shortened to an 11 ns nominally square pulse with a 3 ns rise and fall via a Pockels cell. Two Pockels cells were required to reduce nonlinear effects in the fiber due to prelase signal. The two frequencies were coupled into a 10 m single-mode polarization preserving fiber with a 4.2 x 7.4 μm core diameter and an effective mode area of 64 μm. The beam energy was recorded at the input and output of the fiber. The output spectrum was recorded with a spectrometer/optical multichannel analyzer, and the temporal pulse shape of each frequency was recorded by spectrally dispersing the far field beam and re-imaging it onto a streak camera.

21849 (UCRL-JC–117794) **Multiple pulse traveling wave excitation of neon-like germanium.** Moreno, J.C.; Nilsen, J.; Da Silva, L.B. Lawrence Livermore National Lab., CA (United States). Jun 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940592–12: 4. international colloquium on X-ray lasers, Williamsburg, VA (United States), 16-20 May 1994). Order Number DE95012458. Source: OSTI; NTIS; GPO Dep.

Traveling wave excitation has been shown to significantly increase the output intensity of the neon-like germanium x-ray laser. The driving laser pulse consisted of three 100 ps Gaussian laser pulses separated by 400 ps. Traveling wave excitation was employed by tilting the wave front of the driving laser by 45 degrees to match the propagation speed of the x-ray laser photons along the length of the target. The authors show results of experiments with the traveling wave, with no traveling wave, and against the traveling wave and comparisons to a numerical model. Gain was inferred from line intensity measurements at two lengths.

21850 (UCRL-JC–118281) **Total Internal Reflection Microscopy (TIRM) as a nondestructive surface damage assessment tool.** Liao, Z.M.; Cohen, S.J.; Taylor, J.R. Lawrence Livermore National Lab., CA (United States). Oct 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410155–3: 26. annual symposium on optical materials for high power lasers: Boulder damage symposium, Boulder, CO (United States), 24-26 Oct 1994). Order Number DE95010748. Source: OSTI; NTIS; GPO Dep.

An easy to use, nondestructive, method for evaluating subsurface damage in polished substrates has been established at LLNL. Subsurface damage has been related to laser damage in coated optical components used in high power, high repetition rate laser systems. Total Internal Reflection Microscopy (TIRM) has been shown to be a viable nondestructive technique in analyzing subsurface damage in optical components. A successful TIRM system has been established for evaluating subsurface damage on fused silica components. Laser light scattering from subsurface damage sites is collected through a Nomarski microscope. These images are then captured by a CCD camera for analysis on a computer. A variety of optics, including components with intentional subsurface damage due to grinding and polishing, have been analyzed and their TIRM images compared to an existing destructive etching method. Methods for quantitative measurement of subsurface damage are also discussed.

21851 (UCRL-JC–119202) **Impact of three-dimensional nonuniformity on the germanium x-ray laser output.** Wan, A.S. (Lawrence Livermore National Lab., CA (United States)); Mayle, R.W.; Osterheld, A.L.; Kato, Y. Lawrence Livermore National Lab., CA (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950476–4: 12. international conference on laser interaction and related plasma phenomena, Osaka (Japan), 24-28 Apr 1995). Order Number DE95013429. Source: OSTI; NTIS; GPO Dep.

We are studying the impact of axial nonuniformity of the driving optical laser on the output of x-ray lasers. In this paper we use typical laser focusing parameters from germanium x-ray laser experiments on Gekko XII which has a bowtie-shaped line focus that results in large axial differences of the incident intensity on target This axial nonuniformity of the driving laser intensity produced significant axial variations of spatial gain and density profiles. In this paper we contrast the x-ray laser output of axially homogeneous and in homogeneous germanium x-ray lasers using the numerical

simulation code, XRASER, which includes the effect of laser photon transport, saturation, and refractive propagation in three spatial dimensions and two angular directions of photon phase space.

21852 (UCRL-JC–120006) **Phase control and measurement of ultrashort optical pulses.** Sullivan, A. (Lawrence Livermore National Lab., CA (United States)); White, W.E.; Chu, K.C.; Heritage, J.P. Lawrence Livermore National Lab., CA (United States). 10 Feb 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–40: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95011746. Source: OSTI; NTIS; GPO Dep.

We have used the Direct Optical Spectral Phase Measurement (DOSPM) technique to characterize the cubic phase tuning ability of our pulse stretcher. We have compared the measured phase to the phase determined from cross-correlation measurements.

21853 (WHC-SD-LL-ATP–023) **GENRTC Project No. 2F3E0A, OCB A-382, acceptance test procedure.** Akerson, A.W. Westinghouse Hanford Co., Richland, WA (United States). 10 Apr 1995. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95010739. Source: OSTI; NTIS; GPO Dep.

This test procedure provides the steps necessary to verify correct functional operation of controls, annunciators, alarms, protective relays and related systems impacted by CENRTC #2F3E0A, Microwave Transfer Trip Project, modification work performed under work package 6B-93-00040/M (CENRTC 2F3E0A MWTT OCB A-382 PACKAGE).

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Refer also to citation(s) 21384

21854 (SSC-SR–1017) **Report of the SSC impedance workshop.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. 28 Oct 1985. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-8506212–: SSC impedance workshop, Berkeley, CA (United States), 26-27 Jun 1985). Order Number DE95011080. Source: OSTI; NTIS; GPO Dep.

This workshop focused attention on the transverse, single-bunch instability and the detailed analysis of the broadband impedance which would drive it. Issues discussed included: (1) single bunch stability – impact of impedance frequency shape, coupled-mode vs. fast blowup regimes, possible stopband structure; (2) numerical estimates of transverse impedance of inner bellows and sliding contact shielded bellows; (3) analytic estimates of pickup and kicker impedance contributions; and (4) feasibility studies of wire and beam measurements of component impedance.

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Refer also to citation(s) 20729, 20804, 22141, 22961

21855 (ANL/ASD/CP–84988) **Overall design concepts for the APS storage ring machine protection system.** Lumpkin, A.; Fuja, R.; Votaw, A.; Wang, X.; Shu, D.; Stepp, J.; Arnold, N.; Nawrocki, G.; Decker, G.; Chung, Y. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–221: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013763. Source: OSTI; NTIS; INIS; GPO Dep.

The basic design and status of the machine protection system for the Advanced Photon Source (APS) storage ring are discussed. The machine is passively safe to the bending magnet sources, but the high power of the insertion devices requires missteering conditions to be identified and the beam aborted in less than one millisecond. The basic aspects of waterflow, temperature, beam position, etc. monitoring are addressed. Initial commissioning of subsystems and sensors is statused.

21856 (ANL/ASD/CP–85006) **Lattice considerations for a tau-charm factory.** Teng, L.C.; Crosbie, E.A. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–180: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013410. Source: OSTI; NTIS; INIS; GPO Dep.

The magnet lattice appropriate for a tau-charm factory had been studied extensively. Here we discuss two possible simplifying features which make the design, construction, and operation of the machine simpler without sacrificing performance. These two features may be characterized and identified as (a) luminosity optimization in the "monochromatic" mode, and (b) chromaticity correction with sextupoles only in the arcs.

21857 (ANL/ASD/CP–85047) **Radiation measurements at the Advanced Photon Source (APS) linear accelerator.** Moe, H.J.; Vacca, J.H.; Veluri, V.R.; White, M. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–218: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013699. Source: OSTI; NTIS; INIS; GPO Dep.

The injector and source of particles for the Advanced Photon Source is a 2856-MHz, S-band, electron-positron linear accelerator (linac). It produces electrons with energies up to 650 MeV or positrons with energies up to 450 MeV. Radiation measurements were made during normal electron and positron operation, as well as during several beam loss scenarios. Neutron and gamma measurements made outside the shielding walls during normal operation are within DOE guidelines. Measured radiation fields are compared to predicted levels for different conditions.

21858 (ANL/PHY/CP–85475) **Accelerator complex for a radioactive ion beam facility at ATLAS.** Nolen, J.A. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–205: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013525. Source: OSTI; NTIS; INIS; GPO Dep.

Since the superconducting heavy ion linac ATLAS is an ideal post-accelerator for radioactive beams, plans are being developed for expansion of the facility with the addition of a driver accelerator, a production target/ion source combination, and a low q/m pre-accelerator for radioactive ions. A working group including staff from the ANL Physics Division and current ATLAS users are preparing a radioactive beam facility proposal. The present paper reviews the specifications of the accelerators required for the facility.

21859 (BNL–61776) **The RHIC status update.** Ozaki, S. Brookhaven National Lab., Upton, NY (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950127–12: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95012518. Source: OSTI; NTIS; INIS; GPO Dep.

This report gives a brief discussion of the progress on the Brookhaven RHIC.

21860 (FEI–2379) **Focusing of ion beam with limit emittance by accelerator tube of electrostatic accelerator.** Bazhal, S.V.; Romanov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 17p. (In Russian). Order Number DE95633504. Source: OSTI; NTIS (US Sales Only); INIS.

Focusing of nonrelativistic ion beam with finite emittance by accelerator tube is considered. Analytical relation between positions of the entrance and exit crossovers as a function of the beam emittance and the accelerator tube parameters was obtained. The comparison of conditions providing crossover to crossover transformation and conditions of entrance crossover optical image forming was carried out. 10 refs.; 3 figs.

21861 (FEI–2389) **Accelerator complex with low-energy mixed electron-proton beams.** Glotov, A.I.; Bashmakov, V.S.; Kupriyanov, B.V.; Nikitin, V.A.; Chalyj, Yu.R.; Shlyapnikov, S.V.

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 14p. (In Russian). Order Number DE95633505. Source: OSTI; NTIS (US Sales Only); INIS.

A simulating accelerator complex was developed for space, material, solid state physics, biology and medical researches. It provides a uniform irradiation of large targets in an outward vacuum chamber by electron and proton beams simultaneously or separately in the energy range of 30-150 keV. The electrostatic electron and proton beams scanning system with linear voltage time change allows to obtain a uniform beam density distribution on the target and a wide range control of scanning raster. 3 figs.

21862 (FNAL/C–95/123) **Radiation shielding of the main injector.** Bhat, C.M.; Martin, P.S. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–201: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013243. Source: OSTI; NTIS; INIS; GPO Dep.

The radiation shielding in the Fermilab Main Injector (FMI) complex has been carried out by adopting a number of prescribed stringent guidelines established by a previous safety analysis. Determination of the required amount of radiation shielding at various locations of the FMI has been done using Monte Carlo computations. A three dimensional ray tracing code as well as a code based upon empirical observations have been employed in certain cases.

21863 (JINR–94-1, pp. 92-93) **Deuteron cyclotron complex as a meson and neutron generator.** Alenitskij, Yu.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Glazov, A.A.; Denisov, Yu.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. CYCLOTRONS/deuteron beams; CYCLOTRONS/superconducting magnets; CYCLOTRONS; FLOWSHEETS; MESON FACTORIES; MEV RANGE 100-1000; NEUTRON GENERATORS

21864 (LA-UR–95-1507) **Modified PARMILA code for new accelerating structures.** Takeda, H.; Stovall, J.E. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–105: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011988. Source: OSTI; NTIS; INIS; GPO Dep.

The PARMILA code was originally developed as a numerical tool to design and simulate the beam performance of the drift-tube linac (DTL). The authors have extended PARMILA to the design of both the coupled-cavity linac (CCL) and the coupled-cavity drift-tube linac (CCDTL). They describe the new design and simulation features associated with these linac structures and improvements to the code that facilitate a seamless linac design process.

21865 (LA-UR–95-1508) **A compact high-power proton linac for radioisotope production.** Takeda, H.; Billen, J.H.; Nath, S.; Stovall, J.E.; Wood, R.L.; Young, L.M. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–107: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011987. Source: OSTI; NTIS; INIS; GPO Dep.

Conventional designs for proton linacs use a radiofrequency quadrupole (RFQ), followed by a drift-tube linac (DTL). For higher final beam energies, a coupled cavity linac (CCL) follows the DTL. A new structure, the coupled-cavity drift-tube linac (CCDTL) combines features of an Alvarez DTL and the CCL. Operating in a $\pi/2$ structure mode, the CCDTL replaces the DTL and part of the CCL for particle velocities in the range $0.1 < \beta < 0.5$. The authors present a design concept for a compact linac using only an RFQ and a CCDTL. This machine delivers a few mA of average beam current at a nominal energy of 70 MeV and is well suited for radioisotope production.

21866 (LA-UR–95-1566) **Linac-driven spallation-neutron source.** Jason, A.J. Los Alamos National Lab., NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–152: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011973. Source: OSTI; NTIS; INIS; GPO Dep.

Strong interest has arisen in accelerator-driven spallation-neutron sources that surpass existing facilities (such as ISIS at Rutherford or LANSCE at Los Alamos) by more than an order of magnitude in beam power delivered to the spallation target. The approach chosen by Los Alamos (as well as the European Spallation Source) provides the full beam energy by acceleration in a linac as opposed to primary acceleration in a synchrotron or other circular device. Two modes of neutron production are visualized for the source. A short-pulse mode produces 1 MW of beam power (at 60 pps) in pulses, of length less than 1 ms, by compression of the linac macropulse through multi-turn injection in an accumulator ring. A long-pulse mode produces a similar beam power with 1-ms-long pulses directly applied to a target. This latter mode rivals the performance of existing reactor facilities to very low neutron energies. Combination with the short-pulse mode addresses virtually all applications.

21867 (LBL–36841) **Development of a two-beam high-current ion accelerator based on Doppler effect. Final report (1994).** Ivanov, B.I. (Kharkov Institute of Physics & Technology (Ukraine)); Yegorov, A.M. Lawrence Berkeley Lab., CA (United States). Mar 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012440. Source: OSTI; NTIS; INIS; GPO Dep.

This Final Report presents the results of work accomplished in accordance with the Scope of Work to the Purchase Order No 4596310. The amount of works includes the following items: 1. Start of the manufacture of the Experimental Accelerating Stand (EAS)-the section for proton acceleration from 5 MeV to 8 MeV, in which RF fields are excited by an electron beam at the anomalous Doppler effect. 2. Theoretical investigation and computer simulation of field excitation and ion acceleration in the EAS. Under item 1, the EAS manufacturing is begun. To present time, a pedestal for the EAS and a stainless steel vacuum chamber for RF resonator are made (length of the chamber is about 180 cm, diameter is about 40 cm). Besides, parts of the EAS resonator with the acceleration structure are manufactured, and its assembly is begun. Under item 2, it is realized three works: calculation of increment and frequency shift of the EAS resonator excited by electron beam, calculation of the solenoid for creation of magnetic field with required spatial distribution, and theoretical investigation and computer simulation of ion acceleration in the EAS. 14 figs., 16 refs.

21868 (SAND–95-0915C) **High average power, high current pulsed accelerator technology.** Neau, E.L. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950512–157: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011603. Source: OSTI; NTIS; GPO Dep.

Which current pulsed accelerator technology was developed during the late 60's through the late 80's to satisfy the needs of various military related applications such as effects simulators, particle beam devices, free electron lasers, and as drivers for Inertial Confinement Fusion devices. The emphasis in these devices is to achieve very high peak power levels, with pulse lengths on the order of a few 10's of nanoseconds, peak currents of up to 10's of MA, and accelerating potentials of up to 10's of MV. New which average power systems, incorporating thermal management techniques, are enabling the potential use of high peak power technology in a number of diverse industrial application areas such as materials processing,, food processing, stack gas cleanup, and the destruction of organic contaminants. These systems employ semiconductor and saturable magnetic switches to achieve short pulse durations that can then be added to efficiently give MV accelerating, potentials while delivering average power levels of a few 100's of kilowatts to perhaps many megawatts. The Repetitive High Energy Puled Power project is developing short-pulse, high current accelerator technology capable of generating beams with kJ's of

energy per pulse delivered to areas of 1000 cm^2 or more using ions, electrons, or x-rays. Modular technology is employed to meet the needs of a variety of applications requiring from 100's of kV to MV's and from 10's to 100's of kA. Modest repetition rates, up to a few 100's of pulses per second (PPS), allow these machines to deliver average currents on the order of a few 100's of mA. The design and operation of the second generation 300 kW RHEPP-II machine, now being brought on-line to operate at 2.5 MV, 25 kA, and 100 PPS will be described in detail as one example of the new high average power, high current pulsed accelerator technology.

21869 (SLAC–451, pp. 98-131) **The consideration of Tau-Charm Factory construction in China.** Zhipeng, Zheng (IHEP, Beijing (China)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents a proposal to extend the present Beijing Electron Positron Collider into a Tau Charm Factory. To achieve this aim the author points out that a number of things need to come together, and to be successfully communicated to the Chinese government. Such a machine is a logical extension of the present BEPC device. The physics which can be accomplished at such a device, is important, and cannot be duplicated in planned meson factories, due to the presence of resonances and thresholds which allow minimization of systematic errors. The author stresses the need for international coorperation on this project, to have hope of it coming to fruition. The whole concept of such a Tau Charm Factory needs more support from the high energy physics community.

21870 (SLAC-PUB–95-6849) **Parameters of the SLAC Next Linear Collider.** Raubenheimer, T. (and others); Adolphsen, C.; Burke, D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–136: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013279. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, the authors present the parameters and layout of the Next Linear Collider (NLC). The NLC is the SLAC design of a future linear collider using X-band RF technology in the main linacs. The collider would have an initial center-of-mass energy of 0.5 TeV which would be upgraded to 1 TeV and then 1.5 TeV in two stages. The design luminosity is $> 5 \times 10^{33}$ cm^{-2} sec^{-1} at 0.5 TeV and $> 10^{34}$ cm^{-2} sec^{-1} at 1.0 and 1.5 TeV. They briefly describe the components of the collider and the proposed energy upgrade scenario.

21871 (SSC–53-App.1) **Research and development for the supercollider. Appendix 1.** Tigner, M. (Universities Research Association, Waxahachie, TX (United States)). Superconducting Super Collider Lab., Dallas, TX (United States). 29 Oct 1985. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011213. Source: OSTI; NTIS; GPO Dep.

Chairman Fuqua and members of the Subcommitte, I would like to thank you for this opportunity to describe the status of the supercollider research and development program. Over two years have now elapsed since SSC was given the highest priority by the US high energy community. Shortly after, in the fall of 1983, the Department of Energy formally initiated the R&D phase for this potential facility. The developments in the physics world during these past two years have strengthened the arguments for the SSC. Furthermore, the national effort devoted to the SSC R&D during that time has provided us with firm evidence that the SSC can be built with the existing technology and within the cost estimates originally calculated a year and a half ago. I would like to describe for you today some of the accomplishments of this R&D effort and tell you about our plans for the future. I would also like to touch briefly on the important subject of international collaboration. The main objectives of the research and development effort are: (1) to develop and optimize the components necessary for construction of the SSC. Because the magnets are by far the single most expensive and most critical element of the SSC, the major effort during the past two years has been directed in this area; (2) to perform systems tests of the-magnets and the associated cryogenic and control systems, and thus to optimize the systems aspects of the proposed machine; (3) to define the requirements that have to be satisfied by potential SSC sites; (4) to prepare a complete conceptual design of the SSC, including a detailed cost estimate, and the projected schedule for the construction, tests and start-up of the whole facility.

21872 (SSC–246) **Recommendations following the meetings of September 18–19, 1989 held in DeSoto, Texas.** Superconducting Super Collider Lab., Dallas, TX (United States). 11 Oct 1989. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-8909505–Summ.: Underground Technology Advisory Panel (UTAP) meeting, DeSoto, TX (United States), 18-19 Sep 1989). Order Number DE95011176. Source: OSTI; NTIS; GPO Dep.

This report summarizes recommendations made by the Underground Technology Advisory Panel (UTAP) to the Superconducting Super Collider (SSC) Laboratory, subsequent to meetings held on September 18 and 19, 1989. The panel was convened at the request of Mr. Robert Crawley. Deputy Manager of the Conventional Construction Division for the SSC. A list of UTAP members and meeting agenda are appended to this report. The meeting was held at the Holiday Inn, DeSoto, TX, during which time presentations were made by members of the SSC Laboratory staff on the Texas site geology, site exploration, ring placement, experimental halls, and main beam tunnels and shafts. Information conveyed at the meetings is in the public domain, and has been collected and filed as part of the SSC Laboratory Notes which are available through the SSC Laboratory. Recommendations pertaining to the geotechnical program, presentation of geotechnical information, startup tunnel, groundwater and subsidence monitoring, location of the ring, tunnel and special tunnel areas, and experimental halls are summarized under the headings which follow.

21873 (SSCL–622) **Is transverse feedback necessary for the SSC emittance preservation? (Vibration noise analysis and feedback parameters optimization).** Parkhomchuk, V.V.; Shiltsev, V.D. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011148. Source: OSTI; NTIS; INIS; GPO Dep.

The paper considers the Superconducting Super Collider (SSC) site ground motion measurements as well as data from accelerators worldwide about noises that worsen beam performance. Unacceptably fast emittance growth due to these noises is predicted for the SSC. A transverse feedback system was found to be the only satisfactory alternative to prevent emittance decay. Optimization of the primary feedback parameters was done.

21874 (SSCL-Preprint–38) **Parameter selection for the SSC trade-offs and optimization.** Edwards, D.A.; Syphers, M.J. Superconducting Super Collider Lab., Dallas, TX (United States). 14 Oct 1991. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011046. Source: OSTI; NTIS; INIS; GPO Dep.

In November of 1988, a site was selected in the state of Texas for the SSC. In January of 1989, the SSC Laboratory was established in Texas to adapt the design of the collider to the site and to manage the construction of the project. This paper describes the evolution of the SSC design since site selection, notes the increased concentration on the injector system, and addresses the rationale for choice of parameters.

21875 (SSCL-Preprint–148) **Object-oriented simulation for the Superconducting Super Collider.** Zhou, Jiasheng (Superconducting Super Collider Lab., Dallas, TX (United States)); Chung, Moon-Jung. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011102. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the design and implementation of an object-oriented simulation environment called OZ for the Superconducting Super Collider (SSC). The design applies object-oriented

technology to data visualization, behavior modelling, dynamic simulation and version control. A meta class structure is proposed to model different types of objects in large systems by their functionality. OZ provides a direct-manipulation user interface which allows the user to visualize the data as an object in the database and interactively model the component of the system. Modelling can be exercised at different levels of the class hierarchy and then can be dynamically bound into a system for simulation. Inheritance is used to derive new configurations of the system or subsystem from the existing one, and specify an object's behavior. Delegation is used to construct a system by instantiating existing objects and "stealing" their methods by delegators.

21876 (SSCL-Preprint–168) **SSC design update.** Syphers, M.J. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011106. Source: OSTI; NTIS; INIS; GPO Dep.

Recent developments in the design and construction of the SSC are presented. Topics include status of the 20 TeV Collider rings, including interaction regions, utility regions, and main arcs, plus some remarks on the injector accelerators. Remaining issues facing the design of the colliding beams synchrotron and its injectors are discussed.

21877 (SSCL-Preprint–559) **Overview of radiation protection at the Superconducting Super Collider Laboratory.** Baker, S.; Britvich, G.; Bull, J.; Coulson, L.; Coyne, J.; Mokhov, N.; Romero, V.; Stapleton, G. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-940424–39: 8. international conference on radiation shielding, Arlington, TX (United States), 24-27 Apr 1994). Order Number DE95011038. Source: OSTI; NTIS; INIS; GPO Dep.

The radiation protection program at the Superconducting Super Collider Laboratory is described. After establishing a set of stringent design guidelines for radiation protection, both normal and accidental beam losses for each accelerator were estimated. From these parameters, shielding requirements were specified using Monte-Carlo radiation transport codes. A groundwater activation model was developed to demonstrate compliance with federal drinking water standards. Finally, the environmental radiation monitoring program was implemented to determine the effect of the facility operation on the radiation environment.

21878 (SSCL-SR–1210) **SSCL Commissioning and Operations.** Superconducting Super Collider Lab., Dallas, TX (United States). 31 Mar 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011163. Source: OSTI; NTIS; INIS; GPO Dep.

The SSC, with an energy of 20 TeV/Beam, requires a sequence of individual accelerators of increasing energy in the injector chain. These are the Linac, Low Energy Booster, Medium Energy Booster, and High Energy Booster. Each accelerator system must be completed in sequence in order to provide beam to the next higher energy accelerator. The collider itself is comprised of ten sectors, each of which in terms of superconducting magnet bending strength, is equivalent to two HEB injectors. The completion of all injectors and collider sectors is required before stored beams can circulate in preparation for colliding beam operation. Four experimental halls are planned for the detector systems. Each major detector will be assembled in one of the halls by a world-wide collaboration of scientists. In addition, above ground facilities provide shops and test facilities for accelerator technical systems, superconducting magnet and materials research and development, and for detector assembly and operations. The purpose of this report is to present a plan for the sequential commissioning and operation of these individual accelerators and other technical facilities of the SSC. A central objective of this plan is to describe the activities at the SSCL that are not included as part of the construction project TPC, even though they occur during the overall project construction time-frame. Examples of such activities include the operation of general laboratory facilities and services not specifically related to construction, the operating costs for the individual accelerators in the injector chain once these facilities have been commissioned, and the costs of SSCL physics research groups. The Department of Energy has provided the following decision with regard to these operations categories for the SSCL.

21879 (SSCL-SR–1220) **Report of the tunnel safety working group.** Gannon, J. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011165. Source: OSTI; NTIS; INIS; GPO Dep.

On 18 February 1991 the Project Manager formed a working group to address the safety guidelines and requirements for the underground facilities during the period of accelerator construction, installation, and commissioning. The following report summarizes the research and discussions conducted by the group and the recommended guidelines for safety during this phase of the project.

21880 (SSCL-SR–1230) **Review of scientific and technical options for the Superconducting Super Collider Program.** Dombeck, T. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011168. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a review of options for the Superconducting Super Collider (SSC) Program. It is the result of an informal study by an ad-hoc working group consisting of Laboratory physicists and engineers who investigated the physics and technical implications of a number of possible alternative SSC programs. Previous studies have shown, and early in this study it was confirmed, that a collider of approximately 20 TeV protons on 20 TeV protons with a luminosity of 10^{33} $cm^{-2}s^{-1}$ at each interaction region is needed to support a physics program that is guaranteed to answer existing particle physics questions and make new discoveries. Therefore, all options considered in this document were consistent with attainment of these original goals for the SSC. One promising option considered was a program of colliding anti-protons on protons as a possible means to reduce the cost of the SSC by eliminating one of the Collider rings. However, the luminosity requirements to obtain the SSC physics goals remains the same as for protons colliding with protons and this study confirms that even though progress has been made over the last ten years in obtaining the high intensity anti-proton beams necessary, a luminosity higher than 10^{32} cannot be guaranteed. Other options were examined to see what advantages could be derived by departing from the SSC baseline program, either in schedule, in parameters, by staging, or by combinations of these options. Even though we considered re-examination of the cost of the baseline program to be beyond the scope of this document, differential cost savings were estimated. Finally, a brief survey of progress over the last ten years in various technical areas that might lead to more cost effective engineering designs was included in this study, such as higher magnetic field magnets resulting from lower operating temperatures or higher current-carrying superconducting materials.

21881 (SSCL-SR–1232) **Technical Site Information: Planning group of the Directorate and Conventional Construction Division.** Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011170. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the technical site information for the Superconducting Super Collider project. The Ellis County, Texas site was selected by the Department of Energy in 1989. After assembling the initial staff at temporary facilities in Dallas, the SSC Laboratory began site-specific design work. The resulting design for the SSC accelerators, experimental areas, and laboratory facilities were described in the Site-Specific Conceptual Design Report of July 1990. Since then, design specifications for the technical components and conventional facilities have been formulated. In fact, a very significant amount of surface and underground construction has been initiated and many buildings have been completed. Testing of prototypes for most technical components is advanced. The construction phase of the SSC project is approximately 20% complete. At this time, it is appropriate to capture the conventional design work which has taken place since 1990. This documents records regional and physical information used in site studies, summarizes the site studies for conventional facilities, and presents site layouts for buildings and utilities as they would have been at

the end of the construction project. As such, this documents summarizes and complements the work of many groups in the SSC laboratory, the Texas National Research Laboratory Commission (TNRLC), and several subcontractors to the SSC project. The document contains extensive references to their work contained in other drafts and final reports. In particular, it borrows heavily from the Site Development Plan (released in draft form in January, 1992) which has, to date, guided aspects of site development.

21882 (SSC-SR–1012) **Cost comparisons for SSC magnet dependent systems.** Superconducting Super Collider Lab., Dallas, TX (United States). 15 Aug 1985. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011076. Source: OSTI; NTIS; GPO Dep.

An SSC Cost Estimating Task Force was appointed by the SSC Director in May, 1985. The charge to the task force was to perform a detailed review of costs for all superconducting magnet design styles that are under consideration for the SSC. Cost information on five magnet styles was reviewed in detail by the task force members. The basic cost information was developed by participating laboratories and by industry. Details of the procedure and analysis are presented in Chapter III. The purpose of this report is to provide a comparison of all SSC construction project cost information that is dependent on the various magnet styles. It is emphasized that the costs displayed in the tables of this report are not the total costs for an SSC construction project. Only those systems for which costs vary with magnet style are included. In Appendix E, current results are compared with the relevant parts of the 1984 SSC Reference Designs Study (RDS) cost estimate. Following the method used in the RDS, the costs that are developed here are non-site specific. The labor rates utilized are based on a national average for the various labor categories. The Conventional Systems costs for underground structures are derived from an extension of the "median-site" model as described in the RDS.

21883 (SSC-SR–1015) **Report of the workshop on realistic SSC lattices.** Superconducting Super Collider Lab., Waxahachie, TX (United States). Oct 1985. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-8505408–: Workshop on realistic SSC lattices, Berkeley, CA (United States), May - 4 jun 1985). Order Number DE95011078. Source: OSTI; NTIS; INIS; GPO Dep.

A workshop was held at the SSC Central Design Group from May 29 to June 4, 1985, on topics relating to the lattice of the SSC. The workshop marked a shift of emphasis from the investigation of simplified test lattices to the development of a realistic lattice suitable for the conceptual design report. The first day of the workshop was taken up by reviews of accelerator system requirements, of the reference design solutions for these requirements, of lattice work following the reference design, and of plans for the workshop. The work was divided among four working groups. The first, chaired by David Douglas, concerned the arcs of regular cells. The second group, which studied the utility insertions, was chaired by Beat Leemann. The third group, under David E. Johnson, concerned itself with the experimental insertions, dispersion suppressors, and phase trombones. The fourth group, responsible for global lattice considerations and the design of a new realistic lattice example, was led by Ernest Courant. The papers resulting from this workshop are roughly divided into three sets: those relating to specific lattice components, to complete lattices, and to other topics. Among the salient accomplishments of the workshop were additions to and optimization of lattice components, especially those relating to lattices using 1-in-1 magnets, either horizontally or vertically separated, and the design of complete lattice examples. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

21884 (SSC-SR–1016) **SSC workshop on environmental radiation.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. 9 Jan 1986. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-8510522–Summ.: SSC workshop on environmental radiation, Berkeley, CA (United States), 14-18 Oct 1985). Order Number DE95011079. Source: OSTI; NTIS; GPO Dep.

The Superconducting Super Collider is a 20 TeV-on-20 TeV proton beam collider where two 20-TeV proton accelerators whose beams, rotating in opposite senses, are brought into collision to provide 40 TeV in the center of mass. The scale of the project is set by the 6.6 tesla magnet guide field for the protons which results in a roughly circular machine with a circumference of 83 km (51.5 mi.). The energy scale of the proton beams and the physical scale of the machine are an order of magnitude greater than for any presently operating or contemplated proton accelerator yet the facility must be operated within the same strict radiological guidelines as existing accelerators in the US and Europe. To ensure that the facility conforms to existing and projected guidelines both in design and operation, the Workshop was charged to review the experience and practices of existing accelerator laboratories, to determine the relevant present and projected regulatory requirements, to review particle production and shielding data from accelerators and cosmic rays, to study the design and operational specifications of the Collider, to examine the parameters set forth in the Siting Parameters Document, and to evaluate the computational tools available to model the radiation patterns arising under various operational and failure scenarios. This report summarizes the extensive and intensive presentations and discussions of the Workshop. A great deal of material, much of it in the form of internal reports from the various laboratories and drafts of works in preparation, was provided by the participants for the various topics. This material, including the viewgraphs used by the presenters, forms the background and basis for the conclusions of the Workshop and, as such, is an important part of the Workshop. An introduction to the material and a catalog by topic are presented as section 6 of this report.

21885 (SSC-SR–1022) **An assessment of the antiproton-proton option for the SSC.** Superconducting Super Collider Lab., Dallas, TX (United States). May 1986. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011084. Source: OSTI; NTIS; INIS; GPO Dep.

The Conceptual Design Report (CDR) for the Superconducting Super Collider (SSC) describes a proton-proton collider with an energy of 20 TeV per beam and a maximum luminosity of $10^{33}cm^{-2}s^{-1}$ per collision point. This directly responds to the recommendation made by the High Energy Physics Advisory Panel to the US Department of Energy and the National Science Foundation in July 1983. That recommendation called for the "immediate initiation of a multi-TeV high-luminosity proton-proton collider project with the goal of physics experiments at this facility at the earliest Possible date." The primary Parameters of the SSC in the Conceptual Design Report have been chosen taking account of both the physics discovery reach of the machine and accelerator physics considerations. The endeavor of the study reported here was to compare the feasibility of an antiproton-proton collider with the proton-proton collider presented in the SSC Conceptual Design Report. The rapid advances in the technology of $p\bar{p}$ colliders at CERN and Fermilab suggest that $p\bar{p}$ might be a viable alternative to a PP collider (or might be a first stage of an eventual $p\bar{p}$ collider). There is Potentially a large cost saving from eliminating one 20 TeV ring of magnets since the protons and antiprotons share the same ring. Following this suggestion, workshops at the University of Chicago and at Snowmass have provided a forum for these ideas. These reports formed the starting point for our study.

21886 (SSC-SR–1033) **Radiation levels in the SSC interaction regions.** Groom, D.E. (ed.). Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. 10 Jun 1988. 344p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000 ; AC35-89ER40486. Order Number DE95011094. Source: OSTI; NTIS; GPO Dep.

The radiation environment in a typical SSC detector has been evaluated using the best available particle production models coupled with Monte Carlo simulations of hadronic and electromagnetic cascades. The problems studied include direct charged particle dose, dose inside a calorimeter from the cascades produced by incident photons and hadrons, the flux of neutrons and photons backscattered from the calorimeter into a central cavity, and neutron flux in the calorimeter. The luminosity lifetime at the SSC is dominated by collision losses in the interaction regions, where the luminosity is equivalent to losing an entire full-energy proton beam into the apparatus every six days. The result of an average p-p

collision can be described quite simply. The mean charged multiplicity is about 110, and the particles are distributed nearly uniformly in pseudorapidity (η) over all the angles of interest. The transverse momentum distribution is independent of angle, and for our purposes may be written as $p_\perp \exp(-p_\perp/\beta)$. The mean value of $p_\perp$ may be as high as 0.6 GeV/c. Most of the radiation is produced by the very abundant low-$p_\perp$ particles. The dose or neutron fluence produced by individual particles in this energy region are simulated over a wide variety of conditions, and several measurements serve to confirm the simulation results. In general, the response (a dose, fluence, the number of backscattered neutrons, etc.) for an incident particle of momentum p can be parameterized in the form Np^α, where $0.5 < \alpha < 1.0$. The authors believe most of their results to be accurate to within a factor of two or three, sufficiently precise to serve as the basis for detailed designs.

21887 (SSC-SR–1237) **Assessment of tunnel ground conditions for a two-year stand-by period, January 1994. UTAP report.** Superconducting Super Collider Lab., Dallas, TX (United States). 28 Jan 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011171. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes observations, assessment of ground conditions, and recommendations pertaining to the Collider main ring tunnel at the Superconducting Super Collider (SSC).

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 21856, 21938, 21962, 22012, 22016, 22017, 22059, 22064, 22066, 22067, 22104, 22148, 22537, 22776, 22937, 22938, 22939

21888 (ANL/ASD/CP–85002) **Paraxial expansion of a static magnetic field in a ring accelerator.** Teng, L.C. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–181: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013409. Source: OSTI; NTIS; INIS; GPO Dep.

In the paraxial approximation, trajectories of beam particles in a ring accelerator are computed expanded in powers of lateral displacements and slopes from a closed reference orbit. To do this, one needs first the expanded expressions of the magnetic field and potentials producing the particle motion. This is derived here in a most general form.

21889 (ANL/ASD/CP–85013) **Effects of vertical aperture on beam lifetime at the Advanced Photon Source (APS) storage ring.** Bizek, H.M. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–170: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013416. Source: OSTI; NTIS; GPO Dep.

When a positron's energy deviation $\delta E/E$ exceeds the rf acceptance, or when it receives an angular kick for the betatron motion that exceeds some limiting admittance, the positron will be lost. The main contributions to the total beam lifetime come from single Coulomb and Touschek scattering. In this report we investigate the dependence of the residual gas pressure and the vertical aperture of the Advanced Photon Source storage ring on the total beam. lifetime. We present results of calculating the total beam lifetime as a function of vertical aperture for varying average ring pressure, beam current, and coupling coefficient.

21890 (ANL/ASD/CP–85027) **Effects of imperfections on the dynamic aperture and closed orbit of the IPNS Upgrade synchrotron.** Lessner, E.; Chae, Y.C.; Kim, S. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–161: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012917. Source: OSTI; NTIS; INIS; GPO Dep.

Magnet imperfections and misalignments are analyzed in terms of their effects on the dynamic aperture and closed orbit of the IPNS Upgrade synchrotron. The dynamic aperture is limited primarily by the presence of chromaticity-correcting sextupoles. With the sextupoles energized to the values required to adjust the chromaticities to zero, further reductions of the dynamic aperture caused by dipole strength and roll errors, quadrupole strength and alignment errors, and higher-order multipole errors are studied by tracking. Design specifications for the dipole corrector magnets are obtained and the dynamic aperture is studied before and after correction of the closed orbit. The use of harmonic-correcting sextupoles to reduce the amplitude-dependent tune shifts driven by the chromaticity-correcting sextupoles is investigated.

21891 (ANL/ASD/CP–85054) **Reduction of open-loop low frequency beam motion at the APS.** Decker, G. (and others); Kang, Y.G.; Kim, S. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–208: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013529. Source: OSTI; NTIS; GPO Dep.

The Advanced Photon Source (APS) 7-GeV positron storage ring at Argonne National Laboratory (ANL) produces high brilliance bending magnet and insertion device x-rays for up to 70 x-ray beamlines. To efficiently make use of the storage ring's high brilliance, an extremely tight tolerance has been placed on positron beam stability, namely that the beam be stable to a level which is less than 5% of its rms size. This requirement amounts to ± 4.4 microns rms in the vertical plane and ± 17 microns horizontally, assuming 10% coupling. While real-time closed orbit feedback (discussed elsewhere in these proceedings) will be employed to exceed the required stability requirement, efforts are underway to identify and reduce sources of beam motion in the absence of feedback. These sources include ground- and water-system-induced vibrations in addition to power supply jitter and drift. Results to date of this effort will be presented.

21892 (ANL/PHY/CP–85477) **A concept for emittance reduction of DC radioactive heavy-ion beams.** Nolen, J.A.; Dooling, J.C. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–209: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013533. Source: OSTI; NTIS; INIS; GPO Dep.

Numerical simulations indicate that it should be possible to use an electron beam to strip 1+ DC radioactive ion beams to 2+ or higher charge states with on the order of 50% efficiency. The device, which the authors call an Electron-Beam Charge-State Amplifier, is similar to an Electron Beam Ion Source, except that it is not pulsed, the beams are continuous. The 2+ beams are obtained in a single pass through a magnetic solenoid while higher charge states may be reached via multiple passes. An unexpected result of the ion optics simulations is that the normalized transverse emittance of the ion beam is reduced in proportion to the charge-state gain. Ion beams with realistic emittances and zero angular momentum relative to the optic axis before entering the solenoid will travel though the solenoid on helical orbits which intercept the axis once per cycle. With an ion beam about 2 mm in diameter and an electron beam about 0.2 mm in diameter, the ion stripping only occurs very near the optic axis, resulting in the emittance reduction.

21893 (BNL–52435, pp. 109-120) **Design, simulation and visualization of ultrafast electron optical devices.** Rose-Petruck, C. (Univ. of California, La Jolla, CA (United States)); Wilson, K.R. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings*. 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

Ultrashort electron pulses can in principle be used for measuring the motions of atoms in material samples by electron diffraction. Alternatively, ultrafast diffraction with x-ray pulses could be used for measuring molecular dynamics in condensed phase samples. One way to produce ultrafast x-ray pulses is from ultrafast electron pulses, in an x-ray diode. In order to design such ultrafast electron and x-ray sources, which involve electron trajectories in the presence of space-charge, the authors have developed a simulation and visualization system for charged particle trajectories in electric

and magnetic fields. In the first section they discuss the newly developed software package for simulating and visualizing charged particle optics. In the second section they briefly characterize various techniques to generate ultrashort x-ray pulses. As an illustration, they present simulation results for an x-ray diode with a laser driven photocathode.

21894 (BNL–52461) **Numerical studies of Siberian snakes and spin rotators for RHIC.** Luccio, A. Brookhaven National Lab., Upton, NY (United States). 17 Apr 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012228. Source: OSTI; NTIS; INIS; GPO Dep.

For the program of polarized protons in RHIC, two Siberian snakes and four spin rotators per ring will be used. The Snakes will produce a complete spin flip. Spin Rotators, in pairs, will rotate the spin from the vertical direction to the horizontal plane at a given insertion, and back to the vertical after the insertion. Snakes, 180° apart and with their axis of spin precession at 90° to each other, are an effective means to avoid depolarization of the proton beam in traversing resonances. Classical snakes and rotators are made with magnetic solenoids or with a sequence of magnetic dipoles with fields alternately directed in the radial and vertical direction. Another possibility is to use helical magnets, essentially twisted dipoles, in which the field, transverse the axis of the magnet, continuously rotates as the particles proceed along it. After some comparative studies, the authors decided to adopt for RHIC an elegant solution with four helical magnets both for the snakes and the rotators proposed by Shatunov and Ptitsin. In order to simplify the construction of the magnets and to minimize cost, four identical super conducting helical modules will be used for each device. Snakes will be built with four right-handed helices. Spin rotators with two right-handed and two left-handed helices. The maximum field will be limited to 4 Tesla. While small bore helical undulators have been built for free electron lasers, large super conducting helical magnets have not been built yet. In spite of this difficulty, this choice is dictated by some distinctive advantages of helical over more conventional transverse snakes/rotators: (i) the devices are modular, they can be built with arrangements of identical modules, (ii) the maximum orbit excursion in the magnet is smaller, (iii) orbit excursion is independent from the separation between adjacent magnets, (iv) they allow an easier control of the spin rotation and the orientation of the spin precession axis.

21895 (BNL–61188) **BBAT: Bunch and bucket analysis tool.** Deng, D.P. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–138: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011807. Source: OSTI; NTIS; INIS; GPO Dep.

BBAT is written to meet the need of an interactive graphical tool to explore the longitudinal phase space. It is driven for testing new ideas or new tricks quickly. It is especially suitable for machine physicists or operation staff as well both in the control room during machine studies or off-line to analyze the data. The heart of the package contains a set of c-routines to do the number crunching. The graphics part is wired with scripting language tcl/tk and BLT. The c-routines are general enough that one can write new applications such as animation of the bucket as a machine parameter varies via a sliding scale. BBAT deals with single rf system. For double rf system, one can use Dr. BBAT, which stands for Double rf Bunch and Bucket Analysis Tool. One usage of Dr. BBAT is to visualize the process of bunch coalescing and flat bunch creation.

21896 (BNL–61189) **Rebucketing after transition in RHIC.** Deng, D.P.; Peggs, S. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–142: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011815. Source: OSTI; NTIS; INIS; GPO Dep.

Rebucketing in the Relativistic Heavy Ion Collider, RHIC, describes the process of moving the beam from the 26MHz accelerating system to the 196MHz storage system with as little beam loss as possible. This puts a stringent requirement on the beam longitudinal area done at top energy. The ample bucket space after, but not too close to, transition is explored by computer simulation to relax such stringent conditions.

21897 (BNL–61496) **Phenomenology of crystalline beams in smooth accelerators.** Haffmans, A.F.; Maletic, D.; Ruggiero, A.G. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–215: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013509. Source: OSTI; NTIS; INIS; GPO Dep.

We present a phenomenology of crystalline beams in storage rings. We use the smooth approximation to solve the equations of a test particle moving in the focussing potential of the storage ring, and in that of the other ions We find simple confinement, and stability conditions.

21898 (BNL–61527) **Beam dynamics group summary.** Peggs, S. Brookhaven National Lab., Upton, NY (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9410315–3: Collective effects in large hadron collider, Montreux (Switzerland), 17-22 Oct 1994). Order Number DE95008865. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes the activities of the beam dynamics working group of the LHC Collective Effects Workshop that was held in Montreux in 1994. It reviews the presentations that were made to the group, the discussions that ensued, and the consensuses that evolved.

21899 (BNL–61788) **Damping rates of the SRRC storage ring.** Hsu, K.T. (Synchrotron Radiation Research Center, Hsinchu (Taiwan, Province of China)); Kuo, C.C.; Lau, W.K.; Weng, W.T. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–125: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012315. Source: OSTI; NTIS; INIS; GPO Dep.

The SRRC storage ring is a low emittance synchrotron radiation machine with nominal operation energy 1.3 GeV. The design damping time due to synchrotron radiation is 10.7, 14.4, 8.7 ms for the horizontal, vertical and longitudinal plane, respectively. The authors measured the real machine damping time as a function of bunch current, chromaticity, etc. To damp the transverse beam instability, especially in the vertical plane, they need to increase chromaticity to large positive value. The damping rates are much larger than the design values. Landau damping contribution in the longitudinal plane is quite large, especially in the multibunch mode. The estimated synchrotron tune spread from the Landau damping is in agreement with the measured coherent longitudinal coupled bunch oscillation amplitude.

21900 (CEA-LNS-SAF–94-22) **Tools for the design of high-current linacs.** Lagniel, J.M. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). 1994. 3p. (CONF-9408125–: 17. international LINAC conference, Tsukuba (Japan), 21-26 Aug 1994). Order Number DE95632423. Source: OSTI; NTIS (US Sales Only); INIS.

With the programs usually employed to design linear accelerators, beam dynamics parameters are calculated from data describing the accelerator structure. The desired phase advances (with and without space charge) in the transverse and longitudinal planes are reached after several iterations on the structure parameters. Codes which use the opposite procedure have been written. The phase advances are first chosen thanks to a diagram which gives the tune depressions versus the phase advances without space charge. The structure parameters are then calculated. As shown, it can be applied to radiofrequency quadrupoles (RFQ), DTL and high-energy structures. Up to now, this method has been mainly used to design RFQ linear accelerators. 3 figs., 10 refs.

21901 (DOE/ER/54177–T2) **Half-year progress report FY92/93 NRL HIFAR research program, August 1, 1992–June 31, 1993.** Naval Research Lab., Washington, DC (United States). [1995]. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-92ER54177. Order Number DE95014302. Source: OSTI; NTIS; INIS; GPO Dep.

Progress during this reporting period has been in several areas. The research effort has continued in close collaboration with personnel at LBL and LLNL. In addition, studies of the longitudinal physics, which are jointly supported by the Division of High Energy Physics of the U.S. Department of Energy, have benefitted from collaboration with personnel at the University of Maryland associated with the Maryland transport experiment. The research results supported by this program have been, and will be, actively reported to the scientific community through papers presented at conferences and published in conference proceedings as well as in the refereed literature. The first of these references describe work primarily supported under the current contract, while the remaining references describe work jointly supported by the Division of High Energy Physics. Progress detailed in these manuscripts, currently in preparation, will be included in a later report. The emphasis below is instead concentrated on reporting work, in cooperation with LBL, on the simulation of large aperture quadrupoles, with a further emphasis on the NRL contribution. This work is concentrated on understanding the basic nonlinear physics which is important to the design of large aperture magnetic quadrupoles, as well as the numerical requirements for reliable simulations of that physics. In particular, comparisons between the SHIFT-XY and HIFI simulation codes are presented to determine the conditions under which the HIFI code, which is faster running, but is generally run using less accuracy in the space charge model than SHIFT-XY, can be appropriately employed.

21902 (FNAL/C–95/097) **Calculating luminosity for a coupled Tevatron lattice.** Holt, J.A.; Martens, M.A.; Michelotti, L.; Goderre, G. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–159: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013005. Source: OSTI; NTIS; INIS; GPO Dep.

The traditional formula for calculating luminosity assumes an uncoupled lattice and makes use of one-degree-of-freedom lattice functions, β_H and β_V, for relating transverse beam widths to emittances. Strong coupling requires changing this approach. It is simplest to employ directly the linear normal form coordinates of the one turn map. An equilibrium distribution in phase space is expressed as a function of the Jacobian's eigenvectors and beam size parameters or emittances. Using the equilibrium distributions an expression for the luminosity was derived and applied to the Tevatron lattice, which was coupled due to a quadrupole roll.

21903 (FNAL/C–95/098) **Microwave stability at transition.** Holt, J.A.; Colestock, P.L. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–160: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013004. Source: OSTI; NTIS; INIS; GPO Dep.

The question of microwave stability at transition is revisited using a Vlasov approach retaining higher order terms in the particle dynamics near the transition energy. A dispersion relation is derived which can be solved numerically for the complex frequency in terms of the longitudinal impedance and other beam parameters. Stability near transition is examined and compared with simulation results.

21904 (FNAL/C–95/104) **Mode-coupling instability and bunch lengthening in proton machines.** Ng, K.Y. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–211: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013244. Source: OSTI; NTIS; INIS; GPO Dep.

In proton machines, potential-well distortion leads to small amount of bunch lengthening with minimal head-tail asymmetry. Longitudinal mode-mixing instability occurs at higher azimuthal modes. When the driving resonance is of broad-band, the threshold corresponds to Keil-Schnell criterion for microwave instability. When the driving resonance is narrower than the bunch spectrum, the threshold corresponds to a similar criterion derived before.

21905 (FNAL/C–95/122) **Simulations of transition crossing in the main injector.** Bhat, C.M.; MacLachlan, J.A. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–158: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012972. Source: OSTI; NTIS; INIS; GPO Dep.

The design goal for the Fermilab Main Injector (FMI) is to accelerate a minimum of 6×10^{10} protons per bunch through the transition. We present here the results from simulation studies of the transition crossing in the FMI using the particle tracking code ESME.

21906 (INIS-RU–405, pp. 382-386) **Code spin Lie - the code for calculation of polarization in collider using Lie operators method.** Eidelman, Yu. (AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki); Yakimenko, V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The computer code Spin Lie base on Lie operators for calculation the equilibrium degree of beam polarization in storage rings taking into account the linear resonance. Spin Lie possibility to calculate the dependence of spin-orbit resonances on orbit distortion is shown. 14 refs.

21907 (INIS-RU–405, pp. 413-437) **Problems of using polarization effects in e,γ interactions with monocrystals in spin high-energy physics.** Maisheev, V.A.; Mikhalev, V.L.; Frolov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Some perspective directions of experimental investigations if polarized effects in e,γ-interactions with monocrystals are outlined. Practical applications of these effects in spin high-energy physics for polarized e,γ-beams production together with measurement of beam polarization are considered. 24 refs.; 20 figs.

21908 (LA-UR–95-1547) **Electric fields, electron production, and electron motion at the stripper foil in the Los Alamos Proton Storage Ring.** Plum, M. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–147: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011979. Source: OSTI; NTIS; INIS; GPO Dep.

The beam instability at the Los Alamos Proton Storage Ring (PSR) most likely involves coupled oscillations between electrons and protons. For this instability to occur, there must be a strong source of electrons. Investigation of the various sources of electrons in the PSR had begun. Copious electron production is expected in the injection section because this section contains the stripper foil. This foil is mounted near the center of the beam pipe, and both circulating and injected protons pass through it, thus allowing ample opportunity for electron production. This paper discusses various mechanisms for electron production, beam-induced electric fields, and electron motion in the vicinity of the foil.

21909 (LBL–36842) **Heavy ions acceleration in RF wells of 2-frequency electromagnetic field and in the inverted FEL.** Dzergach, A.I.; Kabanov, V.S.; Nikulin, M.G.; Vinogradov, S.V. Lawrence Berkeley Lab., CA (United States). Mar 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012439. Source: OSTI; NTIS; INIS; GPO Dep.

Last results of the study of heavy ions acceleration by electrons trapped in moving 2-frequency 3-D RF wells are described. A linearized theoretical model of ions acceleration in a polarized spheroidal plasmoid is proposed. The equilibrium state of this plasmoid is described by the modified microcanonical distribution of the Courant-Snyder invariant ("quasienergy" of electrons). Some new

results of computational simulation of the acceleration process are given. The method of computation takes into account the given cylindrical field $E_{011}(\varphi,r,z)$ and the self fields of electrons and ions. The results of the computation at relatively short time intervals confirm the idea and estimated parameters of acceleration. The heavy ion accelerator using this principle may be constructed with the use of compact cm band iris-loaded and biperiodical waveguides with double-sided 2-frequency RF feeding. It can accelerate heavy ions with a charge number Z_i from small initial energies $\sim$ 50 keV/a.u. with the rate $\sim Z_i \cdot 10$ MeV/m. Semirelativistic ions may be accelerated with similar rate also in the inverted FEL.

21910 (LBL–36843) **Investigation of focusing of relativistic electron and positron bunches moving in cold plasma. Final report.** Amatuni, A.Ts.; Elbakian, S.S.; Khachatryan, A.G.; Sekhpossian, E.V. Lawrence Berkeley Lab., CA (United States). Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012441. Source: OSTI; NTIS; INIS; GPO Dep.

This document is the final report on a project to study focusing effects of relativistic beams of electrons and positrons interacting with a cold plasma. The authors consider three different models for the overdense cold plasma - electron bunch interaction. They look at coulomb effects, wakefield effects, bunch parameters, and the effects of trains of pulses on focusing properties.

21911 (LBL–37050) **The beam envelope equation-systematic solution for a periodic quadrupole lattice with space charge.** Lee, E.P. Lawrence Berkeley Lab., CA (United States). Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012761. Source: OSTI; NTIS; INIS; GPO Dep.

Many approximate solutions for matched beam envelope functions with space charge have been developed; they generally have errors of 2-10% for the parameters of interest and cannot be reliably improved. The new, systematic approach described here provides the K-V envelope functions to high accuracy as a power series in the quadrupole gradient. A useful simplification results from defining the sum and difference of the envelope radii; S = (a+b)/2 varies only slightly with distance z along the system axis, and D = (a-b)/2 contains most of the envelope oscillations. To solve the coupled equations for S and D, the quadrupole strength K(z) is turned on by replacing K with αK_1 and letting α increase continuously from 0 to 1. It is found that S and D may be expanded in even and odd powers of α, respectively. Equations for the coefficients of powers of α are then solved successively by integration in z. The periodicity conditions and tune integration close the calculation. Simple low order results are typically accurate to 1% or better.

21912 (SLAC–451, pp. 465-491) **INP studies for a Tau-Charm Factory.** Skrinsky, A. (Budker INP, Novosibirsk (Russian Federation)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of studies undertaken at INP of options for a Tau Charm Factory. Three different beam options have been studied. First is a 'round beam option', allowing axially symmetric beams which yield high tau-pair productivity. The second option involves monochromatic beams, which enhances productivity for narrow $c\bar{c}$ states, gives good tau pair productions in a clean manner, and has a good resonant-to-nonresonant ratio. The third option allows longitudinal polarization, should it prove to be interesting. It is an easy option to implement because it only involves polarized electrons. Work on some of these options is described in terms of experiments on the VEPP-2 device.

21913 (SLAC–451, pp. 593-615) **Polarized beams at SPEAR and Tau-Charm Factory.** Prepost, R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses the issue of polarized beams at storage rings, and what impact this might have on a tau charm factory. Radiative polarization in a storage ring is discussed, and compared with results observed in SPEAR. Depolarization results and theories are then discussed also. Simulation codes developed to study spin depolarization in a storage ring are discussed, as well as hardware to accomplish spin rotation in the machines. The implications of all of these concerns for the physics potential of a tau charm factory are discussed.

21914 (SLAC-PUB–95-6792) **A fast beam-ion instability.** Zimmermann, F.; Raubenheimer, T.O.; Stupakov, G. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–197: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014656. Source: OSTI; NTIS; INIS; GPO Dep.

Mutually driven transverse oscillations of an electron beam and residual gas ions may result in a fast transverse instability. This effect arises either during a single pass of a train of electron bunches or it is caused by ionization electrons oscillating within a single positron bunch. In both cases, the beam oscillations grow exponentially with an exponent proportional to the square root of time. In this report, instability rise times are calculated analytically and compared with computer simulations. The effect considered could be a significant limitation in many future designs.

21915 (SLAC-PUB–95-6804) **Study of beam decoherence in the presence of head-tail instability using a two-particle model.** Stupakov, G.V.; Chao, A.W. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–187: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014649. Source: OSTI; NTIS; INIS; GPO Dep.

The decoherence behavior of a beam centroid motion after a kick is studied using a two-particle model. A simple theory based on averaging of the governing equation is developed. The effects of a finite chromaticity and synchrotron motion are taken into account. Increasing the tune spread in the beam, a transition from a head-tail instability to a stable decay of an initial kick is explicitly demonstrated.

21916 (SLAC-PUB–95-6850) **Beam distribution function after filamentation.** Raubenheimer, T.O.; Decker, F.J.; Seeman, J.T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–135: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013280. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, the authors calculate the beam distribution function after filamentation (phase-mixing) of a focusing mismatch. This distribution is relevant when interpreting beam measurements and sources of emittance dilution in linear colliders. It is also important when considering methods of diluting the phase space density, which may be required for the machine protection system in future linear colliders, and it is important when studying effects of trapped ions which filament in the electron beam potential. Finally, the resulting distribution is compared with measured beam distributions from the SLAC linac.

21917 (SLAC-PUB–95-6881) **Polarization correlations in the SLC final focus.** Decker, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–99: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95010742. Source: OSTI; NTIS; INIS; GPO Dep.

At the SLC, the electron beam polarization (P) is measured by a Compton polarimeter downstream of the Interaction Point. This measurement averages over the entire beam distribution and must be corrected for various correlations to calculate the luminosity (L) weighted polarization. Because the spin rotation in the ARC is energy dependent, off energy particles have lower polarization. These particles may also be poorly focused and contribute less luminosity

due to the higher order chromatic optics of the final focus. The small vertical β function at the interaction point also causes an hour-glass effect, where particles at the head and tail of the bunch have less luminosity. Since there is an energy-z correlation due to the compensation of longitudinal wakefields in the linac, these particles may also have lower polarization. The correlations are: z <-> E (linac), E <-> P (ARC), z <-> L (hour-glass) and E <-> L (chromaticity). The contributions from the z <-> E and z <-> L correlations are discussed.

21918 (SLAC-PUB–95-6888) **A map for the thick beam-beam interaction.** Irwin, J.; Chen, T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–96. Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012561. Source: OSTI; NTIS; INIS; GPO Dep.

The authors give a closed-form expression for the thick beam-beam interaction for a small disruption parameter, as typical in electron-positron storage rings. The dependence on transverse angle and position of the particle trajectory as well as the longitudinal position of collision and the waist-modified shape of the beam distribution are included. Large incident angles, as are present for beam-halo particles or for large crossing-angle geometry, are accurately represented. The closed-form expression is well approximated by polynomials times the complex error function. Comparisons with multi-slice representations show even the first order terms are more accurate than a five slice representation, saving a factor of 5 in computation time.

21919 (SLAC-PUB–95-6905) **Beam trajectory jitter in the SLC linac.** Adolphsen, C.; Slaton, T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–133: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013282. Source: OSTI; NTIS; INIS; GPO Dep.

We present model-independent measurements of the vertical trajectory jitter of the positron beam in the Stanford Linear Collider (SLC) linac and discuss the results of studies aimed at isolating its source.

21920 (SSC–155) **Beam-beam stability in the SSC. A preliminary report.** Tennyson, J.L. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1988. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE95011175. Source: OSTI; NTIS; GPO Dep.

The stability of proton orbits in the SSC is threatened by two principle elements in the beam system: magnet errors and the beam-beam interaction. Of these, magnet errors are considered to be of greater importance because they are more tenacious. Beam-beam effects can be reduced if necessary by widening the beam crossing angle. Magnet errors, however, cannot be removed and their effects are difficult to compensate for. The stability of the beam system is characterized by a curve in the two-dimensional amplitude plane which separates dynamically stable trajectories, at small amplitudes, from dynamically unstable trajectories, at large amplitudes. The area of stable motion is refered to here as the "stability aperture". Protons outside the stability aperture exhibit chaotic motion and are lost rapidly from the beam. Those inside the aperture, in the absence of single particle scattering, remain confined indefinitely. Although the edge of the stability aperture is not a "fine line", as it would be for a one-degree-of-freedom system with time dependence, the amplitudes representing the transition from stable to unstable motion are fairly well defined in the SSC. The primary purpose of this investigation is to roughly determine the size and shape of the stability aperture induced by the beam-beam interaction alone, and its dependence on the principle machine parameters. This information, together with a determination of the magnet error aperture and the combined total aperture, is needed to select the nominal beam crossing angle.

21921 (SSCL–260) **The effect of magnetic peaking on the dynamic aperture.** Garavaglia, T.; Stiening, R. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1990. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011178. Source: OSTI; NTIS; INIS; GPO Dep.

It has been suggested that the dynamic aperture of the SSC can be increased by a suitable choice of the dipole systematic allowed multipole moments so as to extend the uniform field region of the magnet. In this note the effect of combinations of B_4 and B_6 are considered on the tune shifts. These tune shifts have been calculated using the methods of different authors. The results of these calculations are given.

21922 (SSCL–508) **Growth rate in terms of Z⊥.** Briggs, D. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011145. Source: OSTI; NTIS; INIS; GPO Dep.

This report briefly discusses the beam emittance growth rate in terms of transverse impedance.

21923 (SSCL–641) **Transient effect in high intensity proton linear accelerators.** Senichev, Yu. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011184. Source: OSTI; NTIS; INIS; GPO Dep.

We study the possible mechanism of the separatrix destruction during the transient in the linear accelerator. This effect is due to the parametric resonance of the beam in the longitudinal plane caused by the perturbations of electromagnetic field. The magnitude of time-space perturbations of the electromagnetic field depends on the disperse feature of resonator and the beam intensity. In the paper we discuss how to avoid this effect or to decrease its influence.

21924 (SSCL–650) **Calculation of the coupling impedances of holes and slots on the liner using MAFIA and scaling.** Thiagarajan, V.; Barts, T.; Kurennoy, S.; Chou, W. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011252. Source: OSTI; NTIS; INIS; GPO Dep.

The location of a liner inside the beam tube is one of the options considered for the Super Colliders. The liner could serve as a synchrotron radiation intercept and also help enhance the vacuum. A definite distribution of holes or slots is required to be located on the liner for pumping out the desorbing gases. There will be wake fields propagating within the liner due to diffraction at discontinuities following the incident beam fields. The effect of these wake fields can be minimized by adopting the least number of pumping holes/slots required and through an optimal choice of hole/slot shape and size. The effect of the wake fields on the beam may be expressed through coupling impedances defined proportional to the corresponding forces integrated through distance per unit charge. It is necessary to compute the impedance of holes and slots and determine the scaling of the impedance with the dimensions of the hole/slot and the liner, in order to optimize the choice of pumping holes/slots. The coupling impedances of slots and holes have been calculated here using the code MAFIA and the scaling assessed. The results compare favorably with existing analytical results.

21925 (SSCL-Preprint–14) **Perturbation approach and the constant of motion for on-dimensional dynamical systems.** Lopez, G. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011256. Source: OSTI; NTIS; INIS; GPO Dep.

A perturbation technic is used to find the constant of motion of a one-dimensional autonomous system. The convergence of the method is discussed through some examples. In addition, the approach is extended to one-dimensional non-autonomous systems where some examples are given.

21926 (SSCL-Preprint–182) **Synchrotron radiation from protons.** Dutt, S.K. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486.

(CONF-9202111–8: 4. generation light sources workshop, Stanford, CA (United States), 24-27 Feb 1992). Order Number DE95011109. Source: OSTI; NTIS; INIS; GPO Dep.

Synchrotron radiation from protons, though described by the same equations as the radiation from electrons, exhibits a number of interesting features on account of the parameters reached in praxis. In this presentation, we shall point out some of the features relating to (i) normal synchrotron radiation from dipoles in proton machines such as the High Energy Booster and the Superconducting Super Collider; (ii) synchrotron radiation from short dipoles, and its application to light monitors for proton machines, and (iii) synchrotron radiation from undulators in the limit when, the deflection parameter is much smaller than unity. The material for this presentation is taken largely from the work of Hofmann, Coisson, Bossart, and their collaborators, and from a paper by Kim. We shall emphasize the qualitative aspects of synchrotron radiation in the cases mentioned above, making, when possible, simple arguments for estimating the spectral and angular properties of the radiation. Detailed analyses can be found in the literature.

21927 (SSCL-Preprint–188) **Emittance growth due to noise and its suppression with the Feedback system in large hadron colliders.** Lebedev, V. (Budker Institute of Nuclear Physics, Novosibirsk, (Russian Federation)); Parkhomchuk, V.; Shiltsev, V.; Stupakov, G. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011110. Source: OSTI; NTIS; INIS; GPO Dep.

The problem of emittance growth due to random fluctuation of the magnetic field in hadron colliders is considered. Based on a simple one-dimensional linear model, a formula for an emittance growth rate as a function of the noise spectrum is derived. Different sources of the noise are analyzed and their role is estimated for the Superconducting Super Collider (SSC). A theory of feedback suppression of the emittance growth is developed which predicts the residual growth of the emittance in the accelerator with a feedback system.

21928 (SSCL-Preprint–239) **Emittance growth due to power ripple in a hadron collider.** Stupakov, G.V. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011113. Source: OSTI; NTIS; INIS; GPO Dep.

Emittance growth of the beam caused by power supply ripple in the Superconducting Super Collider (SSC) is studied. We find that due to nonlinear terms in the equation of the betatron oscillations, the emittance grows only during an initial transient period, after which its increase saturates at some level. An analytical formula is derived that gives the fractional increase of the emittance as a function of the amplitude of the ripple. Numerical estimates for the SSC are presented.

21929 (SSCL-Preprint–332) **A new method for calculation of low-frequency coupling impedance.** Kurennoy, S.S.; Stupakov, G.V. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011122. Source: OSTI; NTIS; INIS; GPO Dep.

In high-energy proton accelerators and storage rings the bunch length is typically at least a few times larger than the radius of the vacuum chamber. For example, the SSC will have an rms bunch length above 6 cm and a beam-pipe radius below 2 cm. The main concern for beam stability in such a machine is the low-frequency impedance, i.e., the coupling impedance at frequencies wen below the cut-off frequency of the vacuum chamber. In the present paper we develop a new analytical approach for calculation of the low-frequency impedance of axisymmetric structures that allows us to give quick and reliable estimates of contributions to the impedance from various chamber discontinuities. Simple formulae for the longitudinal impedance of some typical discontinuities are obtained.

21930 (SSCL-Preprint–539) **Emittance growth saturation effect in synchrotron machines due to point-like perturbations.** Lopez, G.; Chen, S. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011029. Source: OSTI; NTIS; INIS; GPO Dep.

Analytical estimation of the transverse emittance growth due to a point-like perturbation is performed for a proton synchrotron machine. This emittance growth is caused by the tune spread within the bunch. However, the emittance growth suffers a saturation effect caused by the same tune spread. Computer simulations on the emittance growth due to resistive wall instabilities and feedback systems verify qualitatively this emittance growth saturation effect. These simulations were accomplished in the Medium Energy Booster of the Superconducting Super Collider using the TADIMMI computer code.

21931 (SSCL-Preprint–543) **Constant of motion for a one-dimensional and nth-order autonomous system and its relation to the Lagrangian and Hamiltonian.** Lopez, G. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011153. Source: OSTI; NTIS; INIS; GPO Dep.

A constant of motion is defined for a one-dimensional and nth-differenital-order autonomous svstem. A generalization of the Legendre transformation is given that allows one to obtain a relation among the constant of motion the Lagrangian, and the Hamiltonian. The approach is used to obtain the constant of motion associated with the nonrelativistic third-differential-order Abraham-Lorentz radiation damping equation.

21932 (SSCL-Preprint–561-Rev.1) **Collective behavior of an ensemble of forced duffing oscillators near the 1:1 resonance. Revision 1.** Sen, T.; Ellison, J.; Kauffmann, S. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1994. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011159. Source: OSTI; NTIS; INIS; GPO Dep.

Preserving the beam size (or equivalently the emittance) is a primary aim of accelerator physics. Here we study the effect on the emittance of power supply ripple in the guiding magnetic fields. The collective behavior of forced Duffing oscillators is the natural model to understand this phenomenon. We consider the case when the external frequency is near the linearized natural frequency and nonlinearity and forcing are small. The method of averaging reduces the problem to an autonomous system. A coarse grained long time limit of the phase space density and the rate of approach to this limit are discussed in terms of the autonomous system. We find the frequencies which lead to the largest emittance growth in three different forcing regimes (weak, moderate and relatively large) and also characterize the dependence of emittance growth on forcing amplitude in these regimes.

21933 (SSCL-SR–1038) **Compendation of SSC lattice optics in the presence of dipole field errors: Report of the Correction Element Working Group.** Bintinger, D. (and others); Chao, A.; Forest, E. Superconducting Super Collider Lab., Dallas, TX (United States). Feb 1989. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011791. Source: OSTI; NTIS; GPO Dep.

The assignment of the Correction Element Working Group (CEWG) is to advance the designs of various candidate correction schemes to a point where they can be compared and distilled down to a single plan. Choosing among, the options often involves consideration of incommensurate factors such as cost, practicality, and theoretical performance. Except for minor issues, the CEWG purpose is to gather and array the facts in a form from which these decisions can be rationally made, but not to make the decisions. The present report analyses various schemes for compensating nonlinear multipole errors in the main arc dipoles of the Superconducting Super Collider. Emphasis is on comparing lumped and distributed compensation, on minimizing the total number of correction elements, and on reducing the sensitivity to closed-orbit errors.

21934 (SSCL-SR–1227) **Eighth International Magnetic Measurement Workshop (IMMW-8) presentations.** Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 738p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9309489–: 8. international magnetic measurement workshop, Waxahachie, TX (United States), 27-30 Sep 1993). Order Number DE95011167. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains viewgraphs on magnetic field measurements conducted at the superconducting super collider and other accelerators.

21935 (SSC-SR–1014) **The clustered interaction region option for the SSC.** Superconducting Super Collider Lab., Dallas, TX (United States). 30 Sep 1985. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011077. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains discussions on the following topics: advantages of clustering IR's for conventional facilities; theoretical consideration of optics issues; chromatic properties of test lattices; lattice designs including utility insertions; background and test beam calculations; and beam-beam effects.

4303 Auxiliaries and Components

Refer also to citation(s) 21216, 21835, 21844, 21882, 21893, 21905, 21924, 21934, 22053, 22054, 22070, 22071, 22076, 22148, 22590, 22644, 22688, 22771, 22940, 22942, 22947, 22962

21936 (ANL/ASD/CP–84873) **Design, construction, and procurement methodology of magnets for the 7-GeV Advanced Photon Source.** Gorski, A. (and others); Argyrakis, J.; Biggs, J. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–207: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013528. Source: OSTI; NTIS; GPO Dep.

All major magnets of the Advanced Photon Source (APS) have now been measured and installed in the facility. This paper describes the mechanical design, construction, and procurement philosophy and methodology, and lessons learned from the construction and procurement of more than 1500 magnets for the APS storage ring, injector synchrotron ring, and positron accumulator ring.

21937 (ANL/ASD/CP–84937) **Design and test results of kicker units for the positron accumulator ring at the APS.** Wang, J. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–165: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012291. Source: OSTI; NTIS; GPO Dep.

Three fast kicker units have been designed, tested, and installed in the positron accumulator ring (PAR) at the Advanced Photon Source (APS) for beam injection and extraction. The performance of these kicker units has been satisfactory. This presents the design and test results.

21938 (ANL/ASD/CP–85095) **Study of field ionization in the charge exchange injection for the IPNS upgrade.** Chase, Yong-Chul, Cho, Yanglai. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–222: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013762. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed I-MW neutron spallation source is a rapid-cycling synchrotron (RCS) with a design intensity of 1.04×10^{14} protons. A H- beam from the linac is injected into the synchrotron via the charge exchange process. Due to the high intensity of the beam, the minimization of beam loss is one of the primary concerns. In this paper, we study a possible beam loss associated with field ionization, which includes estimates of the charge fraction and level distribution of the excited hydrogen atoms after stripping, and an estimate of lifetime of the excited hydrogen atoms in the transverse magnetic field.

21939 (ANL/ASD/CP–86682) **A VXI-based, integrated system of beam position monitoring and rf measuremednt for the Advanced Photon Source (APS) linear accelerator.** Grelick, A.E.; Arnold, N.; Clifft, B.; Fuja, R.; Ko, K.; White, M. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950534–2: Conference on real-time computer applications in nuclear, particle and plasma physics (RT), East Lansing, MI (United States), 22-26 May 1995). Order Number DE95013373. Source: OSTI; NTIS; GPO Dep.

A combined system of beam position monitoring and rf measurement has been implemented at the APS S-band linear accelerator (linac). The linac is subdivided into five sectors and each sector is comprised of a klystron and associated accelerating structures. The instrumentation for each sector is located, together with its processor, in two VM mainframes. This system has operated successfully for more than a year.

21940 (ANL-HEP-CP–95-34) **The Argonne Wakefield Accelerator high current photocathode, gun and drive linac.** Schoessow, P. (and others); Chojnacki, E.; Cox, G. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–175: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013374. Source: OSTI; NTIS; INIS; GPO Dep.

The Argonne Wakefield Accelerator (AWA) is a new facility for advanced accelerator research. A major component of the AWA is its drive linac, consisting of a unique high current short pulse L-Band photocathode based gun and special standing wave preaccelerator designed to produce 100 nC, 30 ps electron bunches at 20 MeV. Commissioning on the drive linac is now underway. We report on our initial operating experience with this novel machine, including bunch length and emittance measurements.

21941 (ANL/PHY/CP–86382) **Recent developments in ECRIS technology at Argonne National Laboratory and the New ATLAS 14 GHz ECRIS Project.** Harkewicz, R.; Billquist, P.J.; Pardo, R.C. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9504165–1: 12. international workshop on ECR ion sources, Riken (Japan), 25-27 Apr 1995). Order Number DE95011819. Source: OSTI; NTIS; INIS; GPO Dep.

A summary of recent developments in ECRIS technology taking place at Argonne National Laboratory is presented in this paper. A pulsed laser for ablation of solid material into the source plasma has been used online with the ATLAS PII-ECRIS and has allowed direct time measurements to be made which verify and quantify sequential, step-by-step ionization taking place in an ECRIS. In addition, during the course of these laser studies a method was discovered which, from an operational viewpoint, represents an important new method for incorporating solid materials into an ECRIS. We also report on a new 14 GHz ECRIS currently under construction at Argonne. This new ECRIS, along with a new 300 kV high voltage platform and building addition, will further the capabilities of the ATLAS facility by providing the accelerator with a second, independent ECRIS.

21942 (ANL/XFD/CP–84868) **The elliptical multipole wiggler project.** Gluskin, E. (and others); Frachon, D.; Ivanov, P.M. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38 ; AC02-76CH00016. (BNL–61858; CONF-950512–164: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012261. Source: OSTI; NTIS; GPO Dep.

The elliptical multipole wiggler (EMW) has been designed, constructed, and installed in the X13 straight section of the NSLS X-ray Ring. The EMW generates circularly polarized photons in the energy range of 0.1-10 keV with AC modulation of polarization helicity. The vertical magnetic field of 0.8 T is produced by a hybrid permanent magnet structure with a period of 16 cm. The horizontal magnetic field of 0.22 T is generated by an electromagnet, the core of which is fabricated from laminated iron to operate with a switching frequency up to 100 Hz. There are dynamic compensation trim magnets at the wiggler ends to control the first and second field integrals with very high accuracy throughout the AC cycle. The residual closed orbit motion due to the electromagnet AC operation is discussed.

21943 (BNL–52435, pp. 3-22) **RF photoinjectors: A guide to performance requirements and demands on laser systems.** Rosenzweig, J.B. (Univ. of California, Los Angeles, CA (United States)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the demands on drive laser performance made by the performance expected of present and future rf photocathode injectors. The author reviews the relevant charged particle beam physics of rf photocathode guns as well as the technology and physics applications of these devices. The role of the drive laser is examined within this context. Several examples of demanding future rf photoinjector systems are discussed.

21944 (BNL–52435, pp. 23-40) **Lasers for RF guns: Capabilities of lasers, present and future.** Davis, J. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

A review of commercial laser systems used for cathode illumination in free electron lasers and other RF gun electron sources is presented with emphasis on systems based on solid state laser components. Performance examples and possible future improvements on the systems are discussed.

21945 (BNL–52435, pp. 41-42) **Gigahertz repetition rate AlGaAs/Ti:Sapphire (LISAF) modelocked oscillator/power amplifier laser system for advanced photoinjectors.** Fochs, S.N. (Univ. of California, Davis, CA (United States)); Le Sage, G.P.; McNally, J.D.; Hartemann, F.V.; Luhmann, N.C. Jr.; Heritage, J.P.; Perry, M.D.; Delfyett, P.J. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

A novel AlGaAs /Ti:Sapphire (LiSAF) modelocked oscillator / power amplifier laser system, capable of operating in burst mode (> 100 pulses) at 1.3 GHz, and producing frequency-tripled pulses with an energy > 10 μJ at 278 nm, duration < 500 fs, and jitter < 400 fs to irradiate Cesium Telluride photocathodes is described.

21946 (BNL–52435, pp. 43-54) **The synchro laser system for the CLIC Test Facility.** Schreiber, S. (European Laboratory for Particle Physics CERN, Geneva (Switzerland)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

The CLIC Test Facility at CERN uses a laser driven 3 GHz electron gun. Considerable effort has been spent to develop a laser system, which meets the requirements of the Test Facility. The laser is based on a diode-pumped ND:YLF mode-locked oscillator. It delivers a 250 MHz train of laser pulses at 1047 nm with a length of 6.6 ps. A phase-locked timing stabilizer is used to synchronize the laser with the rf-gun. One or two pulses are amplified to 10 mJ. The amplifier system is based on a regenerative amplifier and two single pass power amplifiers. A set of harmonic generators deliver laser pulses at 523 nm, 262 nm and optional at 209nm. The measured pulse length after amplification and harmonic generations is 8 ± 2 ps (FWHM). A good pointing stability and a reasonable uniform transverse profile is obtained by relay imaging and spatial filtering. For some experiments, a train of electron bunches is used. A new pulse train generator working at 262 nm was developed to split the laser beam into 12 pulses. The simultaneous amplification of two seed laser pulses gives the possibility to double the number of pulses in the train without the need to add further splitting stages.

21947 (BNL–52435, pp. 55-63) **Drive lasers and photocathodes for the advanced free electron laser project.** Kinross-Wright, J. (Los Alamos National Lab., NM (United States)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

This is a status report on the state-of-the-art in photoinjector technology at Los Alamos. Recent progress with cesium telluride photocathodes will be described. The design and performance of the existing drive laser for the Advanced Free Electron Laser project will be reviewed. Finally, efforts underway to produce an all diode-pumped photocathode drive laser will be discussed.

21948 (BNL–52435, pp. 65-72) **The SLAC polarized electron source laser system.** Frisch, J. (Stanford Linear Accelerator Center, CA (United States)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

The Stanford Linear Collider (SLC) has operated a polarized photocathode electron source and titanium sapphire laser for high energy physics collisions for over 6500 hours of nearly continuous operation. The laser system for the source has demonstrated >98.5% total uptime for the duration of the experiment. The laser system uses a pair of titanium sapphire oscillators pumped by frequency doubled YAG lasers to produce 2ns, 250 μJ pulses at wavelengths from 740 nm to 870 nm.

21949 (BNL–52435, pp. 73-88) **The Brookhaven Accelerator Test Facility Nd:YAG laser.** Babzien, M. (Brookhaven National Lab., Upton, NY (United States)); Fisher, A.; Srinivasan-Rao, T. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

A Nd:YAG photocathode laser system is currently being assembled to service the BNL Accelerator Test Facility. The system utilizes a diode-pumped, actively mode-locked Nd:YAG oscillator as the seed for two lamp pumped amplifier stages and subsequent frequency quadruplying. This laser will simultaneously illuminate the metal cathode of a $1\frac{1}{2}$ cell S-band RF gun with a quantum efficiency of 1×10^{-4} at 266 nm, and provide 10 mJ of 1 μm light to control an optical semiconductor switch of the facility's CO_2 laser for laser particle acceleration experiments. Alternatively, pulse trains of up to 250 micropulses can be generated for FEL oscillator experiments. Up to 200 μJ at 266 nm in a single pulse are required for sufficient charge to be injected into the facility's 50 MeV linac and delivered to the various beamline experiments.

21950 (BNL–52435, pp. 89-96) **Diode-pumped lasers and amplifiers for photocathode illumination.** Gifford, M. (Lightwave Electronics Corp., Mountain View, CA (United States)); Steele, T. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

Characteristics of a commercial diode-pumped mode-locked oscillator are discussed, with emphasis on timing stabilization and phase noise. Laboratory results of diode-pumped multipass preamplifier that provides macropulse amplification of 30 dB are presented. Finally, performance of a diode-pumped regenerative amplifier and a power amplifier is discussed.

21951 (BNL–52435, pp. 97-108) **Picosecond laser source with single knob adjustable pulse width.** Scott, R.P. (Univ. of California, Los Angeles, CA (United States)); Bennett, C.V.; Kolner, B.H. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

The authors describe and demonstrate a system which can be used with many types of actively modelocked lasers to create a source of variable width picosecond pulses. This system is an active compression scheme which incorporates a resonant electro-optic quadratic phase modulator to impart the linear frequency chirp on an optical pulse. To demonstrate, they used the modulator

to chirp the 85 ps pulses from a modelocked Nd:YAG laser and subsequently compressed them with a dispersive delay line to less than 6 ps. It is possible with this system to smoothly vary the pulse width from the initial width to the fully compressed width by changing only the RF drive power going to the phase modulator.

21952 (BNL–52435, pp. 123-129) **Laser requirements for RF guns.** Yeremian, D. (SLAC, Stanford, CA (United States)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this working group was to develop a chart showing the laser requirements for various RF Guns that are already completed or are being designed. The beam transport of all these guns predicate similar tolerances on the laser parameters. In addition, to optimize the quantum efficiency and minimize the emittance, capability to control the following parameters would also be desirable: polarization; spot size; energy; pointing; wavelength.

21953 (BNL–52435, pp. 131-146) **Report of the working group on laser systems.** Fisher, A.S. (Brookhaven National Lab., Upton, NY (United States)). Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

The Working Group on Laser Systems considered the laser needs for several of the guns listed by the Working Group on RF-Gun Requirements. Designs were outlined to provide suitable beams, including requirements for stability and reproducible performance. One design, for the proposed LCLS (Linac Coherent Light Source) x-ray FEL at SLAC, was developed in greater detail. The LCLS design in particular incorporates the considerations of the Working Group on Practicalities.

21954 (BNL–52435, pp. 147-153) **A laser system for the TESLA photo-injector.** Will, I. (Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin (Germany)); Sandner, W. Brookhaven National Lab., Upton, NY (United States). [1994]. (CONF-9405276–: Lasers for RF guns, Anaheim, CA (United States), 14-15 May 1994). In *Lasers for RF guns: Proceedings.* 153p. Order Number DE95004856. Source: OSTI; NTIS; INIS; GPO Dep.

A conceptual design for a solid-state laser system with output pulse parameters suitable to drive the photocathode of TESLA test facility is presented. General design considerations to overcome problems resulting from the unusual temporal pulse structure of the TESLA test facility are discussed.

21955 (BNL–61224) **Superconducting sextupoles and trim quadrupoles for RHIC.** Thompson, P. (and others); Anerella, M.; Ganetis, G. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–143: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011814. Source: OSTI; NTIS; INIS; GPO Dep.

RHIC requires 288 sextupole and 72 trim quadrupole magnets. These iron poletip superconducting magnets have been constructed by Everson Electric Co. Room temperature field measurements have been completed for 75% of these magnets with acceptable results. Approximately 15% of them have been tested at 4.6 K for maximum (quench) current. The quench performance for the early magnets was good and improved to excellent during the production run. These magnets have more than 100% margin at quench.

21956 (BNL–61226) **Field quality control through the production phase of RHIC arc dipoles.** Gupta, R. (and others); Jain, A.; Kahn, S. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–156: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011812. Source: OSTI; NTIS; GPO Dep.

The field quality in the arc dipoles built thus far for the Relativistic Heavy Ion Collider (RHIC) not only meets machine requirements but is significantly better than that expected from scaling laws based on previous large scale superconducting magnet production for particle accelerators. In this paper the authors describe the evolution of the present cross section and the design philosophy that has led to these improvements. The techniques described here have been found quite efficient to adopt in the production environment, where schedule and cost considerations become important. Moreover, the techniques developed during the R&D program have resulted in making the saturation induced harmonics negligible, despite the fact that the iron is very close to the coil.

21957 (BNL–61234) **Combined element magnet production for the relativistic heavy ion collider (RHIC) at BNL.** Mulhall, S. (and others); Foelsche, H.; Ganetis, G. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–155: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011811. Source: OSTI; NTIS; GPO Dep.

The production of 432 combined element magnets for RHIC is well underway. These magnets consist of a superconducting corrector, a quadrupole, and a sextupole combined into an integrated cold mass which is inserted into a cryostat. Production experiences as well as test results are reported.

21958 (BNL–61264) **Superconducting 8 CM Corrector magnets for the relativistic heavy ion collider (RHIC).** Morgillo, A. (and others); Escallier, J.; Ganetis, G. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–154: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011810. Source: OSTI; NTIS; GPO Dep.

RHIC will require 420 80 mm Corrector magnets. The magnets are made up of coils wound on a computer controlled wiring machine using ultrasonic power to bond the wire into an epoxy coated flat substrate. The coils are wrapped onto support tubes and concentrically assembled inside an iron yoke. These magnets are being built at Brookhaven National Laboratory (BNL) with more than 280 constructed by May 1, 1995. Design, construction and test results are presented.

21959 (BNL–61847) **A low emittance lattice for the NSLS X-Ray Ring.** Safranek, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–183: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013250. Source: OSTI; NTIS; INIS; GPO Dep.

A new high-brightness lattice for the NSLS X-Ray Ring is presented. The horizontal emittance of the X-Ray Ring can be reduced by a factor of two to three by allowing nonzero dispersion in the insertion device straight sections and by better controlling the periodicity of the dispersion. Beam was stored in a low emittance lattice during machine studies. The dispersion in the operations lattice lacks the 8-fold periodicity of the magnet structure, because the orbit is offset in the sextupoles. During machine studies the focusing effect of the sextupoles was compensated using trim supplies on the quadrupoles in the dispersive straight sections. Measured results will be presented. A discussion of the hardware upgrade requirements that would be necessary to run the low emittance lattice in operations is also included.

21960 (BNL–61878) **Small-gap undulator experiment on the NSLS X-ray Ring.** Stefan, P.M.; Krinsky, S.; Rakowsky, G.; Solomon, L. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–210: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013316. Source: OSTI; NTIS; INIS; GPO Dep.

We report results of an on-going experiment being carried out in the X13 straight section of the NSLS X-ray Ring which explores the limits of the operation of small-gap undulators. In particular, we discuss measurements of stored electron beam lifetime as a function of the vertical aperture presented by a 4-jaw scraper or a variable-aperture vacuum vessel. At an electron beam current of

300 mA the variable-aperture vacuum chamber was closed to an inner aperture of 3.8 mm with no effect on the electron beam lifetime. Measurements of the output radiation spectrum of a 16 mm period undulator at a magnet gap of 7.5 mm are also described.

21961 (CEA-CONF–11883) **Superconducting magnets for particle large accelerators.** Kircher, F. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 1994. 9p. (In French). (CONF-9403230– : 3. Technology Talks, Paris (France), 15-16 Mar 1994). Order Number DE95631318. Source: OSTI; NTIS (US Sales Only); INIS.

The different accelerator types (linear, circular) and the advantages of using superconductivity in particle accelerator are first reviewed. Characteristics of some large superconducting accelerators (Tevatron, HERA, RHIC, LHC CERN) are presented. The design features related to accelerator magnets are reviewed: magnet reproducibility, stability, field homogeneity, etc. and the selected design characteristics are discussed: manufacturing method, winding, shielding, cryostat. CEA involvement in this domain mainly addressing quadrupoles, is presented together with the Large Hadron Collider (LHC) project at CERN. Characteristics and design of detector magnets are also described. 5 figs., 2 tabs.

21962 (CEA-DAPNIA–94-25) **Final focus system with superconducting magnets in the interaction region of the TESLA linear collider.** Klein, E.; Napoly, O.; Rifflet, J.M. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Sep 1994. 3p. (CONF-9408125–: 17. international LINAC conference, Tsukuba (Japan), 21-26 Aug 1994). Order Number DE95632426. Source: OSTI; NTIS (US Sales Only); INIS.

The TESLA final focus system is presented for a center of mass energy of 500 GeV. The effects of magnet misalignment and field errors are analyzed for this system using the recently available program FFADA. A design for the last doublet superconducting quadrupoles, based on the LHC quadrupoles, is proposed. Tolerances to higher multipole components in the last doublet have been analyzed as well as the effect of the detector solenoid. (authors). 5 figs., 1 tab., 6 refs.

21963 (CEA-DAPNIA-SEA–94-03) **Measurements of current intensities from 10^{-18} A to 10^{-6} A emitted from niobium samples under high DC electric fields.** Boussoukaya, M.; Curtoni, A.; Zeitoun-Fakiris, A. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 1994. 4p. (CONF-9405116–: 16. international symposium on discharges and electrical insulation in vacuum: commercial applications and opportunities, Moscow (Russian Federation), 23-30 May 1994). Order Number DE95632469. Source: OSTI; NTIS (US Sales Only); INIS.

An experimental set-up allowing measurements of DC field emission currents in the range of 10^{-18} A to 10^{-6} A in ultra high vacuum ($P < 10^{-10}$ Torr) at room temperature has been developed. The detection of currents in the range of 10^{-18} A to 10^{-12} A was carried out with an electron multiplier located behind a grid anode. Higher currents were measured using a massive anode and a pico-ammeter. The whole system is designed to study niobium samples from sheets used to build electron superconducting accelerator cavities. Comparisons of the electron field emission from samples prepared by different surface treatments as chemical etching, electropolishing, oxide coating by anodization, are done. (authors). 5 figs., 4 refs.

21964 (CONF-9410294–5) **New resistor voltage grading system at the Oak Ridge National Laboratory 25URC tandem accelerator; installation and first experience.** Meigs, M.J.; Haynes, D.L.; Jones, C.M.; Juras, R.C. Oak Ridge National Lab., TN (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 symposium of the North Eastern Accelerator personnel (SNEAP-94); Kalamazoo, MI (United States); 12-15 Oct 1994. Order Number DE95008976. Source: OSTI; NTIS; GPO Dep.

On June 27,1994, installation work was completed on a new resistor-based voltage grading system for the Holifield facility tandem accelerator. This new system replaces the original point-plane corona-discharge system which had inherent disadvantages. Perhaps the worst disadvantages of corona-discharge systems are poor gap-to-gap voltage homogeneity and very low grading currents. It is believed that the resistor-based system will reduce or eliminate these disadvantages as well as some others.

21965 (FNAL/C–95/076-E) **Transition Radiation Detector in the D0 colliding beam experiment at Fermilab.** Piekarz, H. Florida State Univ., Tallahassee, FL (United States). Apr 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950276–3: 7. Vienna wire chamber conference (WCC-95), Vienna (Austria), 13-17 Feb 1995). Order Number DE95011837. Source: OSTI; NTIS; INIS; GPO Dep.

The construction, operation and response of the Transition Radiation Detector (TRD) at DO colliding beam experiment at Fermilab are presented. The use of the TRD signal to enhance electron identification and hadronic rejection in the multiparticle background characteristic for the antiproton-proton interactions at the center-of-mass energy of 1.8 TeV is also described and results are discussed.

21966 (FNAL/C–95/087) **MECAR (Main Ring Excitation Controller and Regulator): A real time learning regulator for the Fermilab Main Ring or the Main Injector synchrotron.** Flora, R.; Martin, K.; Moibenko, A.; Pfeffer, H.; Wolff, D.; Prieto, P.; Hays, S. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–126: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011836. Source: OSTI; NTIS; INIS; GPO Dep.

The real time computer for controlling and regulating the FNAL Main Ring power supplies has been upgraded with a new learning control system. The learning time of the system has been reduced by an order of magnitude, mostly through the implementation of a 95 tap FIR filter in the learning algorithm. The magnet system consists of three buses, which must track each other during a ramp from 100 to 1700 amps at a 2.4 second repetition rate. This paper will present the system configuration and the tools used during development and testing.

21967 (FNAL/C–95/105) **Low-dispersion γ_t jump for the main injector.** Ng, K.Y.; Bogacz, A. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–203: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013236. Source: OSTI; NTIS; INIS; GPO Dep.

A bipolar γ_t-jump design is reported for the Fermilab Main Injector (Lattice MI-17). The total amount of jump is 1.3 units. Both the betatron and dispersion waves are confined, while the betatron tunes remain nearly unchanged. The Fermilab Main Injector has been designed to overcome some of the unfavorable effects on the particle motion around transition energy. Unlike the Main Ring, the Main Injector has a very large aperture, so that beam low due to scraping can be avoided. The bunch area at transition will be less than 0.1 eV-sec, so that the nonlinear Johnsen effect can be avoided. Also rapid ramping across transition is possible, so that the nonadiabatic time can be reduced. Nevertheless, negative-mass instability will develop when the bunch intensity is high enough. The only way to avoid this instability is to incorporate a γ_t jump.

21968 (FNAL/C–95/124) **Design of the MI40 beam-abort dump.** Bhat, C.M.; Martin, P.S.; Russell, A.D. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–212: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013247. Source: OSTI; NTIS; INIS; GPO Dep.

A beam-abort dump for the Fermilab Main Injector to handle 3E13 protons per pulse at 150 Gev has been designed. A 120 GeV beam line goes through the beam-dump off-set by 27cm from its center. The design and the environmental safety aspects of the beam-dump are described here.

21969 (FNAL/C–95/145) **The Fermilab Main Injector dipole and quadrupole cooling design and bus connections.** Satti, J.A. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–216: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013586. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed system for connecting the low conductivity water (LCW) and the electrical power to the magnets is explained. This system requires minimum maintenance. Stainless steel headers supply LCW to local, secondary manifolds which regulate the flow to the dipole and to the copper bus which conduct both power and cooling water to the quadrupole. A combination of ceramic feedthroughs and thermoplastic hoses insulate the piping electrically from the copper bus system. The utilities for the Main Injector are grouped together at the outside wall of the tunnel leaving most of the enclosure space for servicing. Space above the headers is available for future accelerator expansion. The new dipoles have bolted electrical connections with flexible copper jumpers. Separate compression fittings are used for the water connections. Each dipole magnet has two water circuits in parallel designed to minimize thermal stresses and the number of insulators. Two electrical insulators are used in series because this design has been shown to minimize electrolyses problems and copper ion deposits inside the insulators. The design value of the temperature gradient of the LCW is 8°C.

21970 (INIS-RU–405, pp. 387-390) **Saturne II polarized target.** Ball, J. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The proton polarized target system facility used at synchrotron Saturne II is Saclay for nucleon-nucleon elastic scattering studies is described. The proton target is made of 1.5 mm diameter glassy beads of pentanol doped with EHBA-CrV complex. 4 refs.; 3 figs.

21971 (INIS-RU–405, pp. 391-394) **The hydrogen and deuterium atomic beam polarized source as an internal target for NEPTUN experiment.** Ershov, V.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Fimushkin, V.V.; Kiselev, K.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Two polarized jet targets for obtaining a polarized hydrogen jet and deuterium one, proposed for the experiment NEPTUN at the accelerating and storage complex UNK, are described. The magnetic structure of the polarized jet target and the vacuum system of the main accelerator ring ion guide at the target area are shown. 4 refs.; 4 figs.

21972 (INIS-RU–405, pp. 395-404) **Ultracold source prototype for polarized atomic hydrogen beam (ATOM-H).** Ershov, V.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Fimushkin, V.V.; Gai, G.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental investigations to get high-intensity neutral or polarized charged particle beam without microwave technique using ultracold microwave technique using ultracold source prototype of polarized atomic hydrogen beam ATOM-H are described. The pulse hydrogen beam with intensity of $Sx10^{14}$ atom/pulse is detected. 3 refs.; 8 figs.

21973 (INIS-RU–405, pp. 409-412) **Status of the Kharkov linac polarized electron source.** Agranovich, V.L. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Glamazdin, A.V.; Gorbenko, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The description of the GaAs polarized electron source - the Kharkov linac injection prototype. The design goals of the source are summarized. Preliminary results of the source performance testing are presented. The injector energy is 70 keV, beam intensity is 50 μA. Preliminary results of the source performance testing are presented. 3 refs.

21974 (INIS-RU–405, pp. 438-446) **On new possibilities of polarization experiments in proton beams.** Maisheev, V.A.; Mikhalev, V.L.; Frolov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Possibilities of polarized proton and antiproton beams production from $\sigma^+\sigma^+$ hyperon decays, measurements of total cross sections of hadron interactions in a pure-spin states, observation of polarization of protons deflected with a bent monocrystals are considered. 4 refs.

21975 (INIS-RU–405, pp. 451-455) **Snake for POLEX.** Ufimtsev, A.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The snake magnet system for POLEX is described. The snake comprises 12 dipole magnets. The total length of the snake is 30 m, the length of a dipole magnet is 2 m. The snake provides for 3 orthogonal directions of polarization. 6 refs.

21976 (LA-UR–95-1210) **Test results for a heat-treated 4-cell 805 MHz superconducting cavity.** Rusnak, B.; Shapiro, A.H. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–92: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95010934. Source: OSTI; NTIS; INIS; GPO Dep.

Assessing superconducting technology for potential upgrades to existing proton accelerators as well as applications to future high-current machines necessitates developing expertise in the processing and handling of multicell cavities at useful frequencies. In order to address some of these technological issues, Los Alamos has purchased a 4-cell 805-MHz superconducting cavity from Siemens AG. The individual cavity cells were double-sided titanium heat-treated after equatorial welding, then the irises were welded to complete the cavity assembly. The resulting high RRR (residual resistance ratio) in the cells enables stable operation at higher cavity field levels than are possible with lower RRR material. Additionally, the high thermal conductivity of the material is conducive to rf and high peak power processing. The cavity was also cleaned at Los Alamos with high-pressure water rinsing. Results from the initial cavity tests, utilizing various processing techniques, are presented.

21977 (LA-UR–95-1450) **Advanced electromagnetic design of cavities for high current accelerators.** Krawczyk, F.L. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–103: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011999. Source: OSTI; NTIS; GPO Dep.

For high-current accelerators such as those proposed for transmutation technologies or spallation sources, preconstruction numerical modeling has a high importance. Non axisymmetric cavities require a full 3-D modeling. A complex analysis of structures beyond tuning and the calculation of Q and shunt impedance is required and also the interaction with the mechanical properties of the structures has to be taken into account. This paper reports on

recent work done at LANL for proposed beam funnels, a new normal-conducting medium-energy structure (CCDTL) and superconducting cavities for medium energy. The electromagnetic calculations have been done with MAFIA, Rel 3.2, the thermal and stress analysis results reported come from the ABAQUS engineering code.

21978 (LA-UR–95-1501) **Characterization of beam position monitors for measurement of second moment.** Russell, S.J.; Gilpatrick, J.D.; Power, J.F.; Shurter, R.B. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–106: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011991. Source: OSTI; NTIS; INIS; GPO Dep.

A dual-axis beam position monitor (BPM) consists of four electrodes placed at 90° intervals around the probe aperture. The response signals of these lobes can be expressed as a sum of moments. The first order moment gives the centroid of the beam. The second order moment contains information about the rms size of the beam. It has been shown previously that the second order moment can be used to determine beam emittance. To make this measurement, the authors must characterize the BPM appropriately. The approach to this problem is to use a pulsed wire test fixture. By using the principle of superposition, they can build up a diffuse beam by taking the signals from different wire positions and summing them. This is done two ways: first by physically moving a wire about the aperture and building individual distributions, and, second, by taking a two dimensional grid of wire positions versus signal and using a computer to interpolate between the grid points to get arbitrary wire positions and, therefore, distributions. The authors present the current results of this effort.

21979 (LA-UR–95-1506) **Lifetime test on a high-performance dc microwave proton source.** Sherman, J.D.; Hodgkins, D.J.; Lara, P.D.; Schneider, J.D.; Stevens, R.R. Jr. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–108: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011989. Source: OSTI; NTIS; INIS; GPO Dep.

Powerful CW proton linear accelerators (100 mA at 0.5–1 GeV) are being proposed for spallation neutron source applications.These production accelerators require high availability and reliability. A microwave proton source, which has already demonstrated several key beam requirements, was operated for one week (170 hours) in a dc mode to test the reliability and lifetime of its plasma generator. The source was operated with 570 W of microwave (2.45 GHz) discharge power and with a 47-kV extraction voltage. This choice of operating parameters gave a proton current density of 250-mA/cm^2 at 83% proton fraction, which is sufficient for a conservative dc injector design. The beam current was 60–65 mA over most of the week, and was sufficiently focused for RFQ injection. Total beam availability, defined as 47-keV beam-on time divided by elapsed time, was 96.2%. Spark downs in the high voltage column and a gas flow control problem caused all the downtime; no plasma generator failures were observed.

21980 (LA-UR–95-1548) **Ion-chamber-based loss monitor system for the Los Alamos Meson Physics Facility.** Plum, M.A.; Brown, D.; Browman, A.; Macek, R.J. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–148: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011978. Source: OSTI; NTIS; INIS; GPO Dep.

A new loss monitor system has been designed and installed at the Los Alamos Meson Physics Facility (LAMPF). The detectors are ion chambers filled with N_2 gas. The electronics modules have a threshold range of 1:100, and they can resolve changes in beam loss of about 2% of the threshold settings. They can generate a trip signal in 2 μs if the beam loss is large enough; if the response time of the Fast Protect System is included the beam will be shut off in about 37 μs.

21981 (LA-UR–95-1553) **A low-frequency high-voltage rf-barrier-bunching system for high-intensity neutron source compressor rings.** Hardek, T.W.; Ziomek, C.; Rees, D. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–149: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011976. Source: OSTI; NTIS; INIS; GPO Dep.

A Los Alamos design for a 1-MW pulsed neutron source incorporates a ring utilizing an rf-barrier bunching system. This bunching concept allows uniform longitudinal beam distributions with low momentum spread. Bunching cavities are operated at the revolution frequency (1.5 MHz in this case) and each of the 2nd, 3rd, 4th, and 5th revolution frequency harmonics. Their effects combine to maintain a beam free gap in the longitudinal distribution of the accumulated beam. The cavities are driven by low-plate-resistance common-cathode configured retrode amplifiers incorporating local rf feedback. Additional adaptive feed-forward hardware is included to reduce the beam-induced bunching-gap voltages well below that achievable solely with rf feedback. Details of this system are presented along with a discussion of the various feed-back and feed-forward techniques incorporated.

21982 (LBL–35419) **Fabrication and component testing results for a Nb_3Sn dipole magnet.** Dell'Orco, D.; Scanlan, R.M.; Taylor, C.E.; Lietzke, A.; Caspi, S.; van Oort, J.M.; McInturff, A.D. Lawrence Berkeley Lab., CA (United States). Oct 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (SC-MAG–455; CONF-941013–47: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012379. Source: OSTI; NTIS; INIS; GPO Dep.

At present, the maximum field achieved in accelerator R&D dipoles is slightly over 10T, with NbTi conductor at 1.8 K. Although Nb_3Sn has the potential to achieve much higher fields, none of the previous dipoles constructed from Nb_3Sn have broken the 10T barrier. We report here on the construction of a dipole with high current density Nb_3Sn with a predicted short sample limit of 13T. A wind and react technique, followed by epoxy impregnation of the fiberglass insulated coils, was used. The problems identified with the use of Nb_3SD in earlier dipole magnets were investigated in a series of supplemental tests. This includes measurement of the degradation of J_c with transverse strain, cabling degradation, joint resistance measurements, and epoxy strength tests. In addition, coff assembly techniques were developed to ensure that adequate prestress could be applied without damaging the reacted Nb_3Sn cable. We report here the results of these tests and the construction status of this 50 mm bore dipole.

21983 (LBL–35423) **Design and fabrication of end spacers for a 13T Nb_3Sn dipole magnet.** Caspi, S.; Ghiorso, W.B.; Wandesforde, A. Lawrence Berkeley Lab., CA (United States). 17 Oct 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (SC-MAG–459; CONF-941013–44: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012387. Source: OSTI; NTIS; INIS; GPO Dep.

A 13 Tesia R&D dipole magnet is currently being constructed using Nb_3Sn superconducting cable. The four-layer "cosine-theta" magnet uses a wide cable (~15 mm) that will undergo a 650 C reaction after each layer is wound. About 75 bronze spacers at the magnet "ends" separate the winding blocks in such a way that the stored strain energy in the cable is minimized and the integrated field harmonics are reduced. Wax prototypes of the designed spacers were made on a 5-axis milling machine. This method of rapid prototyping required no tooling and enabled us to produce a large number of different end spacers that can be physically inspected and repeatedly modified before final prototypes are made. Spacers were originally machined from wax billets which were later cast in bronze.

21984 (LBL–35425) **Design of a 16T Nb_3Sn twin dipole with a window-frame conductor layout.** van Oort, J.M.; Scanlan, R.M. Lawrence Berkeley Lab., CA (United States). 17 Oct 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (SC-MAG–461; CONF-941013–46:

Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012383. Source: OSTI; NTIS; INIS; GPO Dep.

A simplified design study of a 16T Nb_3Sn twin bore accelerator dipole magnet is presented. The philosophy behind the study is to design a high field magnet with a coil structure optimized for a reasonable Lorentz-load and easy of construction. The coils are of the rectangular window-frame type with modular flat pancake windings, thus eliminating the need for complex coil return ends. The magnetic and structural design is presented and a comparison is made with existing coil layouts for high field magnets.

21985 (LBL–36055-Rev.) **Undulators for short wavelength FEL amplifiers.** Schlueter, R.D. Lawrence Berkeley Lab., CA (United States). Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9408146–14-Rev.: 16. international free electron laser conference, Stanford, CA (United States), 21-26 Aug 1994). Order Number DE95012356. Source: OSTI; NTIS; GPO Dep.

Issues critical to the design of undulators for use in short wavelength FEL amplifiers, such as attainable on-axis field strength, device compactness, field quality, required magnetic gap, and strong focusing schemes, are discussed. The relative strength of various undulator technologies, including pure permanent magnet, hybrid, warm electromagnetic, pulsed, and superconducting electromagnetic devices in both helical and planar configurations are reviewed. Favored design options for proposed short wavelength FELs, such as the Linac Coherent Light Source at SLAC and the DUV Free-Electron Laser at BNL, are presented.

21986 (LBL–36306) **The SSC full cell prototype string test.** McInturff, A.D. (Lawrence Berkeley Lab., CA (United States)); Kraushaar, P.; Burgett, W.; Cromer, L. Lawrence Berkeley Lab., CA (United States); Superconducting Super Collider Lab., Dallas, TX (United States). 17 Oct 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ; AC35-89ER40486. (SC-MAG–480; CONF-941013–45: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012384. Source: OSTI; NTIS; INIS; GPO Dep.

At the conclusion of the SSC half cell magnet string testing program in February, 1993, the preliminary data analysis revealed that several substantive technical questions remained unresolved. These questions were: (1) could the high voltages to ground (>2 kV) measured during fault (quench) conditions be substantially reduced, (2) could the number of magnetic elements that became resistive (quenched) be controlled and 3) did the cryostats of the magnetic elements provide adequate insulation and isolation to meet designed refrigeration loads. To address these and other existing questions, a prototypical fall cell of collider magnets (ten dipoles and two quadrupoles) was assembled and tested. At the conclusion of this testing there were definitive answers to most of the questions with numerical substantiation, the notable exception being the beat leak question. These answers and other results and issues are presented in this paper.

21987 (LBL–36350) **Design and performance of the ALS double-crystal monochromator.** Jones, G. (Lawrence Berkeley Lab., CA (United States)); Ryce, S.; Perera, R.C.C.; Lindle, D.W.; Karlin, B.A.; Woicik, J.C. Lawrence Berkeley Lab., CA (United States). Aug 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ; AC02-76CH00016. (CONF-940714–54: International meeting on synchrotron radiation instrumentation, Stony Brook, NY (United States), 18-22 Jul 1994). Order Number DE95012355. Source: OSTI; NTIS; GPO Dep.

A new "Cowan type" double-crystal monochromator, based on the boomerang design used at NSLS beamline X-24A, has been developed for beamline 9.3.1 at the ALS, a windowless UHV beamline covering the 1-6 keV photon-energy range. Beamline 9.3.1 is designed to simultaneously achieve the goals of high energy resolution, high flux, and high brightness at the sample. The mechanical design has been simplified, and recent developments in technology have been included. Measured mechanical precision of the monochromator shows significant improvement over existing designs. In tests with x-rays at NSLS beamline X-A, maximum deviations in the intensity of monochromatic light were just 7% during scans of several hundred eV in the vicinity of the Cr K edge (6 keV) with the monochromator operating without intensity feedback. Such precision is essential because of the high brightness of the ALS radiation and the overall length of beamline 9.3.1 (26 m).

21988 (LBL–36839) **Field errors in hybrid insertion devices.** Schlueter, R.D. Lawrence Berkeley Lab., CA (United States). Feb 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950261–4: Contribution for Halbach Festschrift, Berkeley, CA (United States), 3 Feb 1995). Order Number DE95012389. Source: OSTI; NTIS; INIS; GPO Dep.

Hybrid magnet theory as applied to the error analyses used in the design of Advanced Light Source (ALS) insertion devices is reviewed. Sources of field errors in hybrid insertion devices are discussed.

21989 (LBL–36844) **Research and development to complete construction of a setup for determination of the longitudinal profile and duration of ultrashort bunches. Final report.** Gazazian, E.D. (Yerevan Physics Inst., Erevan (Armenia)); Ivanian, M.I.; Laziev, E.M.; Avakian, R.A.; Mailian, A.E.; Oganessian, D.L.; Vardanian, A.O. Lawrence Berkeley Lab., CA (United States); Yerevan Physics Inst., Erevan (Armenia); Yerevan Research Inst. for Optical and Physical Measurement (Armenia). Mar 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012442. Source: OSTI; NTIS; INIS; GPO Dep.

Here are presented the results of the authors investigations on the construction of a setup for determination of the longitudinal charge distribution function and duration of ultrashort electron bunches via the measurement of the time-profile of the bunch-generated optical transition radiation (OTR) burst. In the Theoretical Part of the Final Report are obtained conditions that determine the adequacy between the time-profile of OTR flash and bunch longitudinal charge distribution function with account of finiteness of the bunch cross-section and bandwidth of the receiver. The competing processes (bremsstrahlung, luminescence) as well as the boundary roughness effect are considered. The Experimental Part presents the justification for the choice of the target - an OTR-emitter, a description of the measurement scheme, and the main characteristics of the units the setup consists of. An account is given of the OTR simulator and of the setup calibration method. Demands are formulated both to the setup as a whole and to its units. Experimental results are given that confirm correctness of the chosen method. In the Appendix the authors consider alternative methods of solution of the problem posed.

21990 (LBL–36950) **The amplitude and phase control of the ALS Storage Ring RF System.** Lo, C.C.; Taylor, B.; Baptiste, K. Lawrence Berkeley Lab., CA (United States). Mar 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950512–110: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012333. Source: OSTI; NTIS; INIS; GPO Dep.

A 500MHz, 300KW Klystron power amplifier provides RF power to the ALS Storage Ring. In order to accommodate the amplitude and phase changes during beam stacking and decay, which demand continuously varying power levels from the Klystron, four loops are used to keep the system operating properly, with two of those loops dedicated to keeping the two cavity tuners on tune. Description of the control loops and their performance data will be given. Using the modulation anode of the Klystron in the amplitude loop will be discussed.

21991 (SCL–592) **Nitrogen system for the SSC.** McAshan, M.; Thirumaleshwar, M.; Abramovich, S.; Ganni, V. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011147. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider consists of two parallel magnet rings, each 87,120 m in circumference, constructed in a tunnel 25 m to 74 m below ground level. They are operated at a controlled low helium temperature in order to maintain the magnet windings

in the superconducting state. To obtain this condition, the magnet cryostat is designed with a high-quality insulation obtained by a high vacuum chamber, multilayer insulation, and thermal shields at nominal temperatures of 84 K and 20 K. Thermal radiation and the conduction heat load through the supports are intercepted and absorbed by the 84-K shield. Liquid nitrogen provides the refrigeration for these loads. The 84-K shield is anchored to two 63.5-mm stainless-steel tubes. One of the tubes, the "liquid line," serves as a conduit in the distribution system of liquid nitrogen. The other tube, the "vapor line," is used to collect the nitrogen vapor generated in the cooling process and to supply this vapor to,the helium refrigerators for precooling. The vapor line may also be used as a continuous cooler by injecting controlled amounts of liquid nitrogen. The nitrogen system consists of nitrogen supplies; ten nitrogen dewars for the collider and two for the High Energy Booster located on the ground at the main shaft entrances; liquid and vapor transfer lines through the shaft to connect the surface and the tunnel systems; and transfer lines to bypass warm equipment sections of the collider. The nitrogen system is expected to operate at steady state condition except for cooldown, warmup, and system repair, for which transients are expected. During normal operation and standby modes of the collider, temperature, pressure, and mass flow are expected to be constant in all circuits of the nitrogen system. The conceptual design requirements for various flow schemes and the engineering considerations are presented in this report.

21992 (SLAC-PUB–95-6787) **A bunch compressor for the Next Linear Collider.** Emma, P.; Raubenheimer, T.; Zimmermann, F. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–191: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014651. Source: OSTI; NTIS; INIS; GPO Dep.

A bunch compressor design for the Next Linear Collider (NLC) is described. The compressor reduces the bunch length by a factor of 40 in two stages. The first stage at 2 GeV consists of an rf section and a wiggler. The second stage at 10 GeV is formed by an arc, an rf section, and a chicane. The final bunch phase is insensitive to initial phase errors and to beam loading in the intermediate S-band pre-linac. Residual longitudinal aberrations of the system are partially compensated. The bunch compressor encompasses a solenoid spin-rotator system at 2 GeV that allows complete control over the spin orientation.

21993 (SLAC-PUB–95-6789) **A final focus system for the Next Linear Collider.** Zimmermann, F.; Brown, K.; Emma, P.; Helm, R.; Irwin, J.; Tenenbaum, P.; Wilson, P. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–194: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014653. Source: OSTI; NTIS; INIS; GPO Dep.

The final focus of the Next Linear Collider (NLC) demagnifies electron and positron beams of 250–750 GeV energy down to a transverse size of about 2.5 $\times$ 350 nm^2 at the interaction point (IP). The basic layout, momentum bandwidth, vibration tolerances, wakefield effects, and the tunability of the proposed final focus design are discussed. Also a perspective is given on the crab cavity and on effects of the solenoid field in the interaction region.

21994 (SLAC-PUB–95-6790) **Performance of the 1994/95 SLC final focus system.** Zimmermann, F. (and others); Barklow, T.; Ecklund, S. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–193: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014654. Source: OSTI; NTIS; INIS; GPO Dep.

A major upgrade to the SLC final focus was installed in 1994 to eliminate the dominant third-order aberration of the system, and thereby to reduce the vertical beam size at the IP by a factor of two. At low current, the optimal beam size of about 400 nm is now routinely established, and its sensitivity to orbit variations, to changes of emittance and energy spread, and to other beam parameters has been studied. For intensities above 3 $\times$ 10^{10} particles per bunch, tuning is more difficult due to increased fluctuations of energy, orbit, and emittances. Nonetheless, the expected beam size of about 600 nm has been observed. New procedures and diagnostics allow easier tuning and optimization of the final focus, and also a first measurement of the emittance increase in the arcs.

21995 (SLAC-PUB–95-6813) **Damping rate measurements in the SLC damping rings.** Simopoulos, C.; Holtzapple, R.L. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–189: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014503. Source: OSTI; NTIS; INIS; GPO Dep.

The transverse damping rates of the SLC electron and positron damping rings have been measured during the high current physics run at, I = 3.5 $\times$ 10^{10} particles per bunch. The measurements, done over a period of two months, show large fluctuations exceeding the statistical uncertainty of each measurement. The longitudinal damping rate of the positron damping was also measured.

21996 (SLAC-PUB–95-6826) **Compact X-band high power load using magnetic stainless steel.** Tantawi, S.G. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Vlieks, A.E. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–200: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013422. Source: OSTI; NTIS; INIS; GPO Dep.

We present design and experimental results of a high power X-band load. The load is formed as a disk-loaded waveguide structure using lossy, Type 430 stainless steel. The design parameters have been optimized using the recently developed mode-matching code MLEGO. The load has been designed for compactness while maintaining a band width greater than 300 MHz.

21997 (SLAC-PUB–95-6842) **Polarized electron sources.** Clendenin, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–190: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014504. Source: OSTI; NTIS; INIS; GPO Dep.

Polarized electron sources for high energy accelerators took a significant step forward with the introduction of a new laser-driven photocathode source for the SLC in 1992. With an electron beam polarization of >80% and with ~99% uptime during continuous operation, this source is a key factor in the success of the current SLC high-energy physics program. The SLC source performance is used to illustrate both the capabilities and the limitations of solid-state sources. The beam requirements for future colliders are similar to that of the SLC with the addition in most cases of multiple-bunch operation. A design for the next generation accelerator source that can improve the operational characteristics and at least minimize some of the inherent limitations of present sources is presented. Finally, the possibilities for producing highly polarized electron beams for high-duty-factor accelerators are discussed.

21998 (SLAC-PUB–95-6848) **A damping ring design for the SLAC Next Linear Collider.** Raubenheimer, T.O. (and others); Byrd, J.; Corlett, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ; AC03-76SF00098. (CONF-950512–192: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995; LBL–37345). Order Number DE95014505. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we describe the design of the main damping rings and the positron pre-damping ring for the SLAC Next Linear Collider, a future linear collider with a center-of-mass energy of 0.5 to 1.5 TeV. The rings will operate at an energy of 2 GeV with a maximum repetition rate of 180 Hz. The normalized extracted beam emittances are $\gamma\epsilon_x$ = 3 mm-mrad and $\gamma\epsilon_y$ = 0.03 mm-mrad. To provide the necessary damping, the rings must damp multiple trains of bunches. Thus, the beam current is large, roughly 1 A. We will

present the optical layout, magnet designs, and RF systems, along with the dynamic aperture and required alignment tolerances; collective effects will be discussed in another paper.

21999 (SLAC-PUB–95-6891) **Operating experience with high beam currents and transient beam loading in the SLC damping rings.** Minty, M.G.; Akre, R.; Krejcik, P.; Siemann, R.H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–98: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012563. Source: OSTI; NTIS; INIS; GPO Dep.

During the 1994 SLC run the nominal operating intensity in the damping rings was raised from 3.5×10^{10} to greater than 4×10^{10} particles per bunch (ppb). Stricter regulation of rf system parameters was required to maintain stability of the rf system and particle beam. Improvements were made in the feedback loops which control the cavity amplitude and loading angles. Compensation for beam loading was also required to prevent klystron saturation during repetition rate changes. To minimize the effects of transient loading on the rf system, the gain of the direct rf feedback loop and the loading angles were optimized.

22000 (SLAC-PUB–95-6892) **Fast and reliable kicker magnets for the SLC damping rings.** Mattison, T.S.; Cassel, R.L.; Donaldson, A.R.; Gross, G. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–101: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012407. Source: OSTI; NTIS; INIS; GPO Dep.

The design, construction, and operation of a kicker magnet with superior electromagnetic performance and greatly improved radiation tolerance is described. A short flux return of high mu ferrite improves the field strength and linearity with current, and novel metallic field-confining structures minimize the inductance. An 8-cell structure with capacitance integrated into each cell makes the magnet a nearly perfect transmission line. The capacitor dielectric is 1 cm thick alumina-loaded epoxy, processed to eliminate air voids, and cast in a multiple step procedure developed to circumvent epoxy shrinkage. The magnet operates with pulses of up to 40 kV and 3.2 kA at 120 Hz, with magnet transit times of less than 35 nsec and field rise and fall times of less than 60 nsec.

22001 (SLAC-PUB–95-6909) **SLAC modulator availability and impact on SLC operation.** Donaldson, A.R.; Ashton, J.R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–129: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013286. Source: OSTI; NTIS; INIS; GPO Dep.

In 1991, the Stanford Linear Collider (SLC) operated, with diverse accelerator systems, at 60% availability. In the more auspicious 1992 and 1993 runs availability improved to over 80%. For the 94/95 run, the availability was also about 80%. Ignoring the eclectic-accelerator, this discussion will assess the dependence of the SLC on the reliability and hence, availability, of 244 klystron modulator systems that provide power to the machine's bunched-particle beams. Klystron modulator availability must be 99% for the accelerator to function at the 75% level. Fortunately, an excess of modulator/klystrons provides some redundancy and, therefore, allows some freedom from the requirement that all 244 systems perform simultaneously. There are, however, 15 specific exceptions. They populate strategic positions at the injector, damping rings, and positron production area of the accelerator complex. These, systems-without-spares, directly influence overall accelerator availability. Their calculated availability as an ensemble is 90%, but by chance they have operated at up to 99%. Individually, a malfunction can bring an experimental program to a halt. The discussion includes a description of several improvements to increase future availability for the modulator system.

22002 (SLAC-PUB–95-6910) **High current high accuracy IGBT pulse generator.** Nesterov, V.V.; Donaldson, A.R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–127: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013287. Source: OSTI; NTIS; INIS; GPO Dep.

A solid state pulse generator capable of delivering high current triangular or trapezoidal pulses into an inductive load has been developed at SLAC. Energy stored in a capacitor bank of the pulse generator is switched to the load through a pair of insulated gate bipolar transistors (IGBT). The circuit can then recover the remaining energy and transfer it back to the capacitor bank without reversing the capacitor voltage. A third IGBT device is employed to control the initial charge to the capacitor bank, a command charging technique, and to compensate for pulse to pulse power losses. The rack mounted pulse generator contains a 525 μF capacitor bank. It can deliver 500 A at 900V into inductive loads up to 3 mH. The current amplitude and discharge time are controlled to 0.02% accuracy by a precision controller through the SLAC central computer system. This pulse generator drives a series pair of extraction dipoles.

22003 (SSC–106) **Shielding calculations for multi-TeV hadron colliders.** Van Ginneken, A. (Fermi National Accelerator Lab., Batavia, IL (United States)); Yurista, P.; Yamaguchi, C. Fermi National Accelerator Lab., Batavia, IL (United States). Jan 1987. 213p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (FN–447). Order Number DE95011173. Source: OSTI; NTIS; GPO Dep.

The present volume is most easily described as an extension of an earlier similar effort. The extension is mainly to higher energies but it also includes colliding beam simulations as well as muon production and transport. There is also a larger variety of geometries presented. But the purpose remains the same: to provide a collection of graphs which may serve as a rough guide in shielding applications. Detailed designs seldom resemble the idealized cases analyzed here and deserve specific computation with particular attention to any suspected weak spots. The graphs included here are intended to go no further than to form a useful starting point in design work. Such an approach is already quite effective at 1 TeV and below and will become even more so at higher energies where shielding costs are even larger. The choice of standard energies (5, 10 and 20 TeV) reflects the range of collider energies presently contemplated and allows for modest extrapolation outside this range. For fixed target results up to 1 TeV refs. 1 and 2 may be consulted. As in refs. 1 and 2, all results in this volume (except those pertaining to "muon beams") use the Monte Carlo code CASIM. Where π° induced electromagnetic showers are included as, e.g., in muon production or in energy deposition, they are simulated with the AEGIS code. Predictions of CASIM (plus AEGIS where applicable) for target heating, induced radioactivity and absorbed dose in the sub-TeV regime agree quite well with experiment. Likewise CASIM results compare well with a set of absorbed dose measurements taken outside thick shields for a variety of beam loss and shielding geometries. The full extension of CASIM into the multi-TeV domain requires considerable modifications to both particle production and particle transport models. This extension is presently only partly completed.

22004 (SSC–124) **Criteria for the SSC helium refrigerator.** VanderArend, P. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1987. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011174. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following criteria for the SSC helium refrigerator: Cryogenic system description; required services for the magnet system; transport of cryogenic fluids around the rings; steady state loads; magnet system cooldown; helium storage facility; refrigerator requirements after a quench; refrigerator capacity; refrigerator redundancy; future expandability; utilities; and description of refrigeration plant studied by the CDG.

22005 (SSCL–261) **Irradiation of fiber optics in the SSC tunnel.** Dickey, C.E. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1990. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011179. Source: OSTI; NTIS; INIS; GPO Dep.

The salient question is not whether optical fiber will survive in the Super Conducting Supercollider (SSC) tunnel, but rather how long will it survive. Current estimates indicate that single mode fiber under ideal conditions will have an expected lifetime of at least 25 years. Future development of optical fiber will lead to longer service lifetimes and increased radiation hardness. But conservatively speaking, current production optical fibers can probably not be depended upon for more than 25 years of service even under ideal conditions.

22006 (SSCL–271) **A dynamic model for helium core heat exchangers.** Schiesser, W.E. (Lehigh Univ., Bethlehem, PA (United States)); Shih, H.J.; Hartozog, D.G.; Herron, D.M.; Nahmias, D.; Stuber, W.G.; Hindmarsh, A.C. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1990. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-900348–26: 2. international industrialization symposium on the super collider (IISSC), Miami, FL (United States), 14-16 Mar 1990). Order Number DE95011225. Source: OSTI; NTIS; INIS; GPO Dep.

To meet the helium (He) requirements of the superconducting supercollider (SSC), the cryogenic plants must be able to respond to time-varying loads. Thus the design and simulation of the cryogenic plants requires dynamic models of their principal components, and in particular, the core heat exchangers. In this paper, we detail the derivation and computer implementation of a model for core heat exchangers consisting of three partial differential equations (PDES) for each fluid stream (the continuity, energy and momentum balances for the He), and one PDE for each parting sheet (the energy balance for the parting sheet metal); the PDEs have time and axial position along the exchanger as independent variables. The computer code can accommodate any number of fluid streams and parting sheets in an adiabatic group. Features of the code include: rigorous or approximate thermodynamic properties for He, upwind and downwind approximation of the PDE spatial derivatives, and sparse matrix time integration. The outputs from the code include the time-dependent axial profiles of the fluid He mass flux, density, pressure, temperature, internal energy and enthalpy. The code is written in transportable Fortran 77, and can therefore be executed on essentially any computer.

22007 (SSCL–274) **Bulk Modulus Capacitor Load Cells.** Dickey, C.E. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-900348–25: 2. international industrialization symposium on the super collider (IISSC), Miami, FL (United States), 14-16 Mar 1990). Order Number DE95011180. Source: OSTI; NTIS; INIS; GPO Dep.

Measurement of forces present at various locations within the SSC Model Dipole collared coil assembly is of great practical interest to development engineers. Of particular interest are the forces between coils at the parting plane and forces that exist between coils and pole pieces. It is also desired to observe these forces under the various conditions that a magnet will experience such as: during the collaring process, post-collaring, under the influence of cryogens, and during field excitation. A twenty eight thousandths of an inch thick capacitor load cell which utilizes the hydrostatic condition of a stressed plastic dielectric has been designed. These cells are currently being installed on SSC Model Dipoles. The theory, development, and application of these cells will be discussed.

22008 (SSCL–332) **The status of detectors at the SSC.** Stefanski, R. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1990. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9009329–2: Workshop on physics at UNK, Protvino (USSR), 25-28 Sep 1990). Order Number DE95011229. Source: OSTI; NTIS; INIS; GPO Dep.

The announcement of the location of the SSC at the site near Waxahachie, Texas was made in January, 1989. Since then a great many important steps have been taken toward the start of the new Laboratory. Some 900 people have been brought to the site as the starting nucleus of the staff that will ultimate number about 2200. A design baseline has been completed that includes a conceptual design for the accelerator, and the detectors. Also, the process has begun to determine the configuration of detectors that will be built for the SSC. This process has several steps, and now the first of these has been taken: The detector collaborations have submitted the Expression of Interest to the Laboratory. These were reviewed by Laboratory management and the Physics Advisory Committee in July, 1990 and recommendations were made to the collaborations. Decisions were deferred for all of the detectors. But perhaps the most significant recommendation was the request to reduce the size and cost of the general purpose detectors. The detector collaborations are now reviewing their initial designs to prepare for the Letters of Intent, the next step in the detector planning process. This is clearly a difficult and crucial step in that the redesign of the detectors must be done with minimal reduction in detector quality. It is an interesting time in the development of the new laboratory, and a crucial time for the ultimate physics that will be done at the SSC.

22009 (SSCL–388) **A model for local current decay in a superconducting LR chain.** Garavaglia, T.; Kauffmann, K. Superconducting Super Collider Lab., Dallas, TX (United States). 1 Apr 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011140. Source: OSTI; NTIS; INIS; GPO Dep.

Solutions are given for the decay of the local current in both a finite and an infinite superconducting circuit consisting of a linear array of loops each containing in series an inductance L and in parallel a resistance R. Numerical results obtained from these solutions are given, and the results for local current decay for both cases are compared The properties of polynomials associated with the finite chain solution and two generating functions along with the method of solution of the diffusion type equation associated with the infinite chain model are discussed in the appendices. These solutions are used to obtain insight into the nature of the time decay of the currents in the loops resulting from crossings of the strands forming the superconducting cable of the SSC dipole magnets.

22010 (SSCL–453) **Refrigeration plants for the SSCL.** McAshan, M.; Ganni, V.; Than, R.; Niehaus, T. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-910340–55: 3. annual international industrialization symposium on the super collider (IISSC), Atlanta, GA (United States), 13-15 Mar 1991). Order Number DE95011142. Source: OSTI; NTIS; INIS; GPO Dep.

The basic requirements and operating features of the collider cryogenic system have already been described in other publications. The general arrangement of the refrigeration plant and its subsystems is presented, and the issue of how to provide redundancy in the cryogenic system is addressed, and some of the basic features of the refrigeration plants are described. The collider cryogenic system design is not final yet, and this report only reflects the direction and current status of the cryogenic system design.

22011 (SSCL–627) **VxWorks v5.1 benchmark tests.** Botlo, M.; Jagielski, M.; Romero, A. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011149. Source: OSTI; NTIS; INIS; GPO Dep.

We measure the performance of the VxWorks Real-time Operating System on various VME single-board computers and compare VxWorks (v5.02) and VxWorks(v5.1).

22012 (SSCL–655) **A study of the HEB longitudinal dynamics.** Larson, D.J. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011185. Source: OSTI; NTIS; INIS; GPO Dep.

A study of the High Energy Booster (HEB) longitudinal dynamics is presented. Full derivations of ramp dependent longitudinal variables are given. The formulas assume that the input magnetic field and beam longitudinal emittance are known as a function of time, and that either the rf voltage or the rf bucket area are known as a function of time. Once these three inputs are specified, the formulas can be used to calculate values for all other longitudinal dynamics variables. The formulas have been incorporated into a single computer code named ELVIRA: Evaluation of Longitudinal Variables in Relativistic Accelerators. The ELVIRA code is documented here in detail. The ELVIRA code is used under two initial

longitudinal emittance assumptions to plot ramp functions for the longitudinal dynamics design of the HEB as of May 5, 1992.

22013 (SSCL–656) **Design of a synchrotron radiation detector for the test beam lines at the Superconducting Super Collider Laboratory.** Hutton, R.D. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1994. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011186. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the particle- and momentum-tagging instrumentation required for the test beam lines of the Superconducting Super Collider (SSC), the synchrotron radiation detector (SRD) was designed to provide electron tagging at momentum above 75 GeV. In a parallel effort to the three test beam lines at the SSC, schedule demands required testing and calibration operations to be initiated at Fermilab. Synchrotron radiation detectors also were to be installed in the NM and MW beam lines at Femilab before the test beam lines at the SSC would become operational. The SRD is the last instrument in a series of three used in the SSC test beam fines. It follows a 20-m drift section of beam tube downstream of the last silicon strip detector. A bending dipole just in of the last silicon strip detector produces the synchrotron radiation that is detected in a 50-mm-square cross section NaI crystal. A secondary scintillator made of Bicron BC-400 plastic is used to discriminate whether it is synchrotron radiation or a stray particle that causes the triggering of the NaI crystal's photo multiplier tube (PMT).

22014 (SSCL–657) **A bipolar integrator for secondary emission profile monitors at the SSCL.** Datte, P.; Beechy, D.; Webber, R. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011253. Source: OSTI; NTIS; INIS; GPO Dep.

Many invasive techniques for monitoring beam profile and intensity require secondary emission signals in order to make the measurement. Signal acquisition and processing can take many forms. This paper describes a bipolar integration technique which uses the Burr-Brown ACF2101 Dual Switched Integrator chip and applications for accelerator beam instrumentation.

22015 (SSCL–658) **Activation of the liquid helium contamination during its passage in the Collider ring.** Lopez, G. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011254. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactivation of possible contamination of the liquid helium trapped in the arcs of the Collider ring of the Superconducting Super Collider and transported by the liquid helium is estimated. This estimation is used to calculate the dose rate on the filter of the refrigerator plant located at the top of the shaft.

22016 (SSCL–669) **Injection system of teh SSC Medium Energy Booster.** Mao, N.; Gerig, R.; McGill, J.; Brown, K. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011187. Source: OSTI; NTIS; INIS; GPO Dep.

The Medium Energy Booster (MEB) is the third of the SSCL accelerators and the largest of the resistive magnet synchrotrons. It accelerates protons from an injection momentum of 12 GeV/c to a top momentum of 200 GeV/c. A beam injection system has been designed to inject the beam transferred from the Low Energy Booster onto the MEB closed orbit in the MEB injection insertion region. The beam is injected via a vertical bending Lambertson septum magnet and a horizontal kicker with appropriate matching and very little beam loss and emittance dilution. The beam optics of the injection system is described in this paper. The required parameters of the Lambertson septum magnet and the injection kicker are given.

22017 (SSCL–670) **Above-cutoff impedance measurements of pumping holes for the Collider Liner.** Walling, L.; Barts, T.; Ruiz, E.; Turner, W.; Spayd, N. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011188. Source: OSTI; NTIS; INIS; GPO Dep.

A holed liner was considered for the Superconducting Super Collider (SSC) Collider Ring because of vacuum problems caused by photon-induced desorption. The liner would serve to shield the cold surface of the beam tube from the synchrotron radiation and the holes (or slots) would allow distributed pumping by gas-absorption material that could be placed between the liner and the beam tube. The impedance of holes and slots in a liner were studied by means of simulations using both MAFIA and HFSS, analytical modelling, wire measurements and electron beam measurements.

22018 (SSCL-Preprint–31) **Muon systems.** Bensinger, J. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011039. Source: OSTI; NTIS; INIS; GPO Dep.

The designs of both the GEM and SDC muon systems an the technological choices are reviewed. In particular, the chamber options for the detectors are discussed.

22019 (SSCL-Preprint–37) **Quench propagation velocity for highly stabilized conductors.** Mints, R.G. (Tel Aviv Univ. (Israel)); Ogitsu, T.; Devred, A. Superconducting Super Collider Lab., Dallas, TX (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011040. Source: OSTI; NTIS; INIS; GPO Dep.

Quench propagation velocity in conductors having a large amount of stabilizer outside the multifilamentary area is considered. It is shown that the current redistribution process between the multifilamentary area and the stabilizer can strongly effect the quench propagation. A criterion is derived determining the conditions under which the current redistribution process becomes significant, and a model of effective stabilizer area is suggested to describe its influence on the quench propagation velocity. As an illustration, the model is applied to calculate the adiabatic quench propagation velocity for a conductor geometry with a multifilamentary area embedded inside the stabilizer.

22020 (SSCL-Preprint–107) **A method of lines solution of the transient behavior of the helium cooled power leads for the SSC.** Demko, J.A.; Schiesser, W.E.; Carcagno, R.; McAshan, M. Superconducting Super Collider Lab., Dallas, TX (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011117. Source: OSTI; NTIS; INIS; GPO Dep.

In this study, a detailed numerical thermal mode of a 6.5 kA power lead for the Superconducting Super Collider has been developed, which was adapted from the dynamic model developed by Schiesser. The transient behavior of the power leads was modeled using, a method of lines (MOL) approach. The model was developed to pmvide a tool for analyzing coolant control strategies as well as an understanding of the behavior of the leads under presumed system transients. Results for a current ramp up to 4970 amps are favorably compared with measurements. Also, a loss of cooling situation is predicted to determine the transient temperature distribution under an off-design condition.

22021 (SSCL-Preprint–121) **A method to quench and recharge avalanche photo diodes for use in high rate situations.** Regan, T.O. (Superconducting Super Collider Lab., Dallas, TX (United States)); Fenker, H.C.; Thomas, J.; Oliver, J. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011050. Source: OSTI; NTIS; INIS; GPO Dep.

We present a new method of using Avalanche Photo Diodes (APDS) for low level light detection in Geiger mode in high rate situations such as those encountered at the Superconducting Super Collider (SSC). The new technique is readily adaptable to implementation in CMOS VLSI.

22022 (SSCL-Preprint–133) **Quench performance of 50-mm aperture, 15-m-long SSC dipole magnets built at Fermilab.**

Kuzminski, J. (and others); Bush, T.; Coombes, R. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011101. Source: OSTI; NTIS; INIS; GPO Dep.

The quench performance, ramp rate dependence, and mechanical behavior of ten full-length, 50-mm-aperture, SSC dipole magnets built at Fermilab are discussed. Cold testing of these magnets shows that the quench plateau established at 4.35 K exceeds the design value by more than 10%, virtually without training.

22023 (SSCL-Preprint–162) **Full-power test of a string of magnets comprising a half-cell of the Superconducting Super Collider.** Burgett, W. (and others); Christianson, M.; Coombes, R. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011104. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper we describe the full-powered operation of a string of industrially-fabricated magnets comprising a half-cell of the Superconducting Super Collider (SSC). The completion of these tests marks the first successful operation of a major SSC subsystem. The five 15-m long dipole magnets in the string had an aperture of 50 mm and the single 5-m long quadrupole aperture was 40 mm. Power and cryogenic connections were made to the string through spool pieces that are prototypes for SSC operations. The string was cooled to cryogenic temperatures in early July, 1992, and power tests were performed at progressively higher currents up to the nominal SSC operating point above 6500 amperes achieved in mid-August. In this paper we report on the electrical and cryogenic performance of the string components and the quench protection system during these initial tests.

22024 (SSCL-Preprint–195-Rev.A) **Interaction between beam control and rf feedback loops for high Q cavities an heavy beam loading. Revision A.** Mestha, L.K. (Superconducting Super Collider Lab., Dallas, TX (United States)); Kwan, C.M.; Yeung, K.S. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1994. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011112. Source: OSTI; NTIS; INIS; GPO Dep.

An open-loop state space model of all the major low-level rf feedback control loops is derived. The model has control and state variables for fast-cycling machines to apply modern multivariable feedback techniques. A condition is derived to know when exactly we can cross the boundaries between time-varying and time-invariant approaches for a fast-cycling machine like the Low Energy Booster (LEB). The conditions are dependent on the Q of the cavity and the rate at which the frequency changes with time. Apart from capturing the time-variant characteristics, the errors in the magnetic field are accounted in the model to study the effects on synchronization with the Medium Energy Booster (MEB). The control model is useful to study the effects on beam control due to heavy beam loading at high intensities, voltage transients just after injection especially due to time-varying voltages, instability thresholds created by the cavity tuning feedback system, cross coupling between feedback loops with and without direct rf feedback etc. As a special case we have shown that the model agrees with the well known Pedersen model derived for the CERN PS booster. As an application of the model we undertook a detailed study of the cross coupling between the loops by considering all of them at once for varying time, Q and beam intensities. A discussion of the method to identify the coupling is shown. At the end a summary of the identified loop interactions is presented.

22025 (SSCL-Preprint–250) **Measurement of complex surfaces.** Brown, G.M. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486 ; AC03-76SF00098. Order Number DE95011114. Source: OSTI; NTIS; INIS; GPO Dep.

Several of the components used in coil fabrication involve complex surfaces and dimensions that are not well suited to measurements using conventional dimensional measuring equipment. Some relatively simple techniques that are in use in the SSCL Magnet Systems Division (MSD) for incoming inspection will be described, with discussion of their suitability for specific applications. Components that are submitted for MSD Quality Assurance (QA) dimensional inspection may be divided into two distinct categories; the first category involves components for which there is an approved drawing and for which all nominal dimensions are known; the second category involves parts for which 'reverse engineering' is required, the part is available but there are no available drawings or dimensions. This second category typically occurs during development of coil end parts and coil turn filler parts where it is necessary to manually shape the part and then measure it to develop the information required to prepare a drawing for the part.

22026 (SSCL-Preprint–265) **The low energy booster project status.** Tuttle, G.W. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–112: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011116. Source: OSTI; NTIS; INIS; GPO Dep.

In order to achieve the required injection momentum, the Superconducting Super Collider (SSC) has an accelerator chain comprised of a Linear Accelerator and three synchrotrons. The Low Energy Booster (LEB) is the first synchrotron in this chain. The LEB project has made significant progress in the development of major subsystems and conventional construction. This paper briefly reviews the performance requirements of the LEB and describes significant achievements in each of the major subsystem areas. Highlighted among these achievements are the LEB foreign collaborations with the Budker Institute of Nuclear Physics (BINP) located in Novosibirsk, Russia.

22027 (SSCL-Preprint–267) **Corrector magnets: Combined structural analysis of collier 50 mm aperture ordered wound dipoles interior section.** Tran, Vu H. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–121: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011197. Source: OSTI; NTIS; INIS; GPO Dep.

The 50mm aperture prototype collider ordered wound dipole connector magnets have been modeled with finite element techniques considering the individual and combined load cases of the preloading from keys, cooldown to 4 K and the effect of magnetic forces during energizing. Results of the analysis are presented as longitudinal, transverse and shear stresses for the ordered wound coils and as maximum von Mises stress for the carbon steel outer laminations, the stainless steel inner lamination, and the carbon steel keys.

22028 (SSCL-Preprint–269) **Corrector magnets: Combined structural analysis of collider 50 mm aperture ordered wound quadrupoles interior section.** Tran, Vu H. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–113: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011118. Source: OSTI; NTIS; INIS; GPO Dep.

The 50mm aperture prototype collider ordered wound quadrupole corrector magnets have been modeled with finite element techniques considering the individual and combined load cases of the preloading from keys, cooldown to 4 K and the effect of magnetic forces during energizing. Results of the analysis are presented as longitudinal, transverse and shear stresses for the ordered wound coils and as maximum von Mises stress for the carbon steel outer laminations, the stainless steel inner lamination, and the carbon steel keys.

22029 (SSCL-Preprint–291) **A comparison of least squares linear regression and measurement error modeling of warm/cold multipole correlation in SSC prototype dipole magnets.** Pollock, D. (Superconducting Super Collider Lab., Dallas, TX

(United States)); Kim, K.; Gunst, R.; Schucany, W. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537--111: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011121. Source: OSTI; NTIS; INIS; GPO Dep.

Linear estimation of cold magnetic field quality based on warm multipole measurements is being considered as a quality control method for SSC production magnet acceptance. To investigate prediction uncertainties associated with such an approach, axial-scan (Z-scan) magnetic measurements from SSC Prototype Collider Dipole Magnets (CDM's) have been studied. This paper presents a preliminary evaluation of the explanatory ability of warm measurement multipole variation on the prediction of cold magnet multipoles. Two linear estimation methods are presented: least-squares regression, which uses the assumption of fixed independent variable (xi) observations, and the measurement error model, which includes measurement error in the xi's. The influence of warm multipole measurement errors on predicted cold magnet multipole averages is considered. MSD QA is studying warm/cold correlation to answer several magnet quality control questions. How well do warm measurements predict cold (2kA) multipoles? Does sampling error significantly influence estimates of the linear coefficients (slope, intercept and residual standard error)? Is estimation error for the predicted cold magnet average small compared to typical variation along the Z-Axis? What fraction of the multipole RMS tolerance is accounted for by individual magnet prediction uncertainty?

22030 (SSCL-Preprint–298) **Equipment acquisition plans for the SSCL magnet excitation power system.** Winje, R. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–114: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011119. Source: OSTI; NTIS; INIS; GPO Dep.

This report gives a brief description of the major electrical technical equipment used in the Superconducting Super Collider accelerators systems and the present laboratory plans for the acquisition of the equipment.

22031 (SSCL-Preprint–313) **Advances in the use of tomographic inspection techniques for non-destructive analysis of geometric conductor position and correlation with magnetic cross-section modeling.** Bein, D. (Superconducting Super Collider Lab., Dallas, TX (United States)); Snitchler, G.; Rabaey, G.F.; Bolger, J.; Crane, R. Morgan, I.L.; Vinson, M. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–115: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011120. Source: OSTI; NTIS; INIS; GPO Dep.

Industrial Computerized Tomography has been applied to magnet components in various stages of the manufacturing process. These Computerized Tomographic images can be analyzed to infer detailed dimensional information about magnet component positions (conductor, wedges, collars, etc.) throughout the magnet manufacturing process (cable winding, collaring, yoked/skinned). An analysis technique will be presented and measurement accuracies will be discussed.

22032 (SSCL-Preprint–420) **Industrial metrology as applied to large physics experiments.** Veal, D. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011123. Source: OSTI; NTIS; INIS; GPO Dep.

A physics experiment is a large complex 3-D object (typ. 1200 m^3, 35000 tonnes), with sub-millimetric alignment requirements. Two generic survey alignment tasks can be identified; first, an iterative positioning of the apparatus subsystems in space and, second, a quantification of as-built parameters. The most convenient measurement technique is industrial triangulation but the complexity of the measured object and measurement environment constraints frequently requires a more sophisticated approach. To enlarge the "survey alignment toolbox" measurement techniques commonly associated with other disciplines such as geodesy, applied geodesy for accelerator alignment, and mechanical engineering are also used. Disparate observables require a heavy reliance on least squares programs for campaign pre-analysis and calculation. This paper will offer an introduction to the alignment of physics experiments and will identify trends for the next generation of SSC experiments.

22033 (SSCL-Preprint–422) **A quench detection/logging system for the SSCL Magnet Test Laboratory.** Kim, K.; Coles, M.; Dryer, J.; Lambert, D. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–110: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011124. Source: OSTI; NTIS; INIS; GPO Dep.

The quench in a magnet describes a process which occurs while the superconductivity state goes to the normal resistive state. The consequence of a quench is the conversion of the stored electromagnetic energy into heat. During this process the initiating point will reach a high temperature, which will char the insulation or melt the conductor and thereby destroy the magnet. To prevent the magnet from being lost, it is standard practice to observe several resistance and/or inductance voltages across the magnet as quench signatures – detection. When a quench symptom is detected, protection operations are initiated: proper shutdown of the magnet excitation systems and treatment to dilute the heat energy at a spot – protection. The temperature rise is diluted by firing heaters along the length of the magnet to insure that the dissipated energy is spread. To develop a reliable quench detection system, two distinct approaches have been tried in the past: (i) Understanding of the Noise Mechanism and Sub-system Optimization, and (ii) Escaping from the Known Electromagnetic Noises by Observing Optical Waves or Acoustic Waves. The MTL of SSCL confronts a mass-measurement of about 10,000 production magnets. To meet the testing schedule, the false quench detection rate needs to be further optimized while the true quench detection rate remains secure for the magnet measurement safety. To meet these requirements, we followed an iterative top-down approach. First we defined the signal and noise characteristics of the quench phenomena by using existing software tools to build a rapid prototype system incorporating all proven functionality of the existing system. Then we further optimize the system through iterative upgrading based on our signal and noise character findings.

22034 (SSCL-Preprint–431) **SSC string test facility for superconducting magnets: Testing capabilities and program for collider magnets.** Kraushaar, P.; Burgett, W.; Dombeck, T.; McInturff, A.; Robinson, W.; Saladin, V. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–523: PAC '93: international particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE95011125. Source: OSTI; NTIS; INIS; GPO Dep.

The Accelerator Systems String Test (ASST) R&D Testing Facility has been established at the SSC Laboratory to test Collider and High Energy Booster (HEB) superconducting magnet strings. The facility is operational and has had two testing periods utilizing a half cell of collider prototypical magnets with the associated spool pieces and support systems. This paper presents a description of the testing capabilities of the facility with respect to components and supporting subsystems (cryogenic, power, quench protection, controls and instrumentation), the planned testing program for the collider magnets.

22035 (SSCL-Preprint–434) **Collider scenario implications of ASST Operation.** McInturff, A.D. (and others); Burgett, W.; Christianson, M. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–524: PAC '93: international particle accelerator

conference, Washington, DC (United States), 17-20 May 1993). Order Number DE95011126. Source: OSTI; NTIS; INIS; GPO Dep.

After the achievement of the SSCL's Congressionally Mandated milestone, the Accelerator System String Test (ASST) half cell under went a series of power tests. These tests involved quenches induced in various configurations and in power levels up to the maximum operation point. These tests have produced data which has defined various parameters and requirements for the individual elements and system.

22036 (SSCL-Preprint–450) **Conceptual design of the CEM design of the data acquisition system.** Bowden, M.; Dorenbosch, J.; Kapoor, V. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930640–9: RT '93: 8th IEEE conference on real-time computer applications in nuclear, particle and plasma physics, Vancouver (Canada), 8-11 Jun 1993). Order Number DE95011128. Source: OSTI; NTIS; INIS; GPO Dep.

The design of a large scale data acquisition system for the GEM detector at the Superconducting Super Collider (SSC) is presented. This architecture supports high-bandwidth data transfer using parallel point-to-point links and a scalable switching network. Substantial buffering enables the use of high latency, selective triggering based on either hardware or software implementations. The system throughput can be expanded to greater than 40 Gbps per second at trigger rates of 100 KHz.

22037 (SSCL-Preprint–455) **Constant of thermal heat conduction and stabilization of the bus bar conductor for superconducting accelerators.** Lopez, G. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930703–46: International cryogenic materials conference (ICMC), Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE95011132. Source: OSTI; NTIS; INIS; GPO Dep.

Using the one-dimensional, time-independent conduction state, a constant of thermal heating conduction is given that brings about the known stabilization theorem and a closed expression for the bus bar to be cryogenically stable in superconducting accelerators.

22038 (SSCL-Preprint–458) **Higher efficiency active quenching circuit for avalanche photodiodes.** Fenker, H.; Regan, T.; Thomas, J.; Wright, M. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011133. Source: OSTI; NTIS; INIS; GPO Dep.

An improved circuit for actively quenching and recharging avalanche photodiodes (APDs) which allows them to be biased to at least 30V above breakdown is presented. Using this circuit it is possible to achieve the high single photon detection efficiency inherent in Geiger mode APDs while maintaining a modest deadtime. The circuit is described and observed characteristics of the system are shown.

22039 (SSCL-Preprint–471) **Industrial harmonic analysis system for magnetic measurements of SSC collider arc and high energy booster corrector magnets.** Green, M.I.; Sponsel, R.; Sylvester, C. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–117: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011135. Source: OSTI; NTIS; INIS; GPO Dep.

The SSCL collider arc and high energy booster corrector magnets are 50 mm bore cryogenic magnets. The integral strength and harmonics will be measured by industry at full current at 4.2 K and at plus and minus 400 mA at room temperature. Dipoles, quadrupoles, and sextupoles have error tolerances of a few tens of units. A prototype harmonic analysis system for magnetic measurements of production and prototype dipole, quadrupole and sextupole magnets has been designed and is being fabricated. We describe the criteria for search coil designs, data acquisition system hardware and software. Radial search coil arrays are being fabricated utilizing multifilar wire. Two digital integrators will allow simultaneous accumulation of unbucked and bucked configurations.

22040 (SSCL-Preprint–479) **Off-line analysis software for the Texas Test Rig.** Yost, G.P. GEM Collaboration. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–120: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011199. Source: OSTI; NTIS; INIS; GPO Dep.

Data analysis for the TTR requires integrating a large number of muon chamber technologies, each with different requirements, into a single analysis chain. Many of these technologies come with their own software, which have different conventions; these packages are grafted on. Data are stored on a tape robot with essential information stored in a database where it may be queried. Operation is done from special-purpose X™ windows designed to facilitate data selection and its subsequent analysis. Program development was done using the Hewlett-Packard Softbench™ product.

22041 (SSCL-Preprint–494) **Thermal conductivity of commercially available 21-6-9 stainless steel.** Yuecel, A.; Maddocks, J.R. Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011137. Source: OSTI; NTIS; INIS; GPO Dep.

Thermal conductivity values of 21-6-9 stainless steel over the temperature range of 5 K to 120 K are reported. Thermal conductivity integrals are measured using a steady-state heat flux method. The resulting data are fit with a polynomial and differentiated to obtain the conductivity. The derived conductivity is compared to published data for high-manganese stainless steels and to data for other stainless steels. A discussion of the methodology and its accuracy is included.

22042 (SSCL-Preprint–500) **Status of superconducting magnets for the Superconducting Super Collider.** Schermer, R.I. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930926–42: 13. international conference on magnet technology, Victoria (Canada), 20-24 Sep 1993). Order Number DE95011200. Source: OSTI; NTIS; INIS; GPO Dep.

The arc sections of the High Energy Booster and the two Collider Rings will need more than 10,000, very large, superconducting dipole and quadrupole magnets. Development work on these magnets was carried out at US/DOE laboratories in a program that began in the mid 1980's. In 1991-1992, the technology was transferred to industry and twenty, full-length, Collider dipoles were successfully fabricated and tested. This program, along with HERA and Tevatron experience, has provided industry a data base to use in formulating detailed designs for the prototypes of the accelerator magnets, with an eye to reducing cost and enhancing producibility. Several model magnets from this latest phase of the industrial program have already been tested. The excessive ramp-rate sensitivity of the magnets is understood and solutions are under investigation.

22043 (SSCL-Preprint–508) **Heat leak performance of SSC collider dipole magnets.** Weisend, J.G. II (Superconducting Super Collider Lab., Dallas, TX (United States)); Levin, M.; Franks, D.; Pletzer, R.; Augustynowicz, S.; McInturff, A.D.; Boroski, W.B. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930926–41: 13. international conference on magnet technology, Victoria (Canada), 20-24 Sep 1993). Order Number DE95011222. Source: OSTI; NTIS; INIS; GPO Dep.

The large number of superconducting dipoles in the SSC results in a stringent heat leak budget for each dipole. Ensuring that the dipoles meet this budget is vital to the successful operation or the collider. This work surveys heat leak measurements taken during 4 different magnet string tests. These tests involved both 40 mm and SO mm aperture dipoles. In these experiments the heat leak to the 80 K shield, 20 K shield and cold mass are measured. The results

are compared to predictions from a computational thermal model of the dipole cryostat. Discrepancies are seen between the predicted and measured values. Possible explanations for these discrepancies are given.

22044 (SSCL-Preprint–521) **Superconducting magnets, cryostats, and cryogenics for the interaction region of the SSC.** Jayakumar, R.J. (and others); Abramovich, S.; Zhmad, A. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011216. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider (SSC) has two counterrotating 20-TeV proton beams that will be made to collide at specific interaction points to carry out high energy physics experiments. The Collider ring has two sites, West and East, for such Interaction Regions (IRs), and the conceptual design of the East Interaction Region is underway. The East IR, in the present stage of design, has two interaction points, the requirements for which have been specified in terms of distance L* to the nearest magnet and the beam luminosity. Based on these requirements, the optics for transition from arc regions or utility regions to the IR and for focusing the beams have been obtained. The optical arrangement consists of a tuning section of quadrupoles, the strength of which is adjusted to obtain the required beta squeeze; a pair of bending dipoles to reduce the beam separation from the nominal 900 mm to 450 mm; an achromat section of quadrupoles, which consist of two cold masses in one cryostat; another pair of dipoles to bring the beams together at the required crossing angle; and a set of final focus quads facing the interaction point. The optics is symmetric about the interaction point, and the two interaction points are separated by a hinge region consisting of superconducting dipoles and quadrupoles similar to the arc region. In the regions where the beams are vertically bent and straightened out by dipoles, the beam traverses warm regions provided for placing beam collimators. The superconducting magnets, including the final focus quadrupoles, operate with supercritical He at 4 atm and a nominal temperature of 4.15 K. In this paper, descriptions of the magnets, the cryostats, and cryo bypasses around the warm region and interaction points are provided. Also discussed are the cooling requirements and design for the final focus quadrupole, which receives significant heat load from beam radiation.

22045 (SSCL-Preprint–522) **SSCL RFQ-DTL Matching Section instrumentation.** Datte, P. (and others); Aielo, R.; Hayworth, M. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011215. Source: OSTI; NTIS; INIS; GPO Dep.

A description of the SSCL RFQ-DTL Matching Section instrumentation is presented with emphasis on design issues and early instrumentation commissioning results. The H^- beam energy through the RFQ-DTL matching section is 2.5 MeV, the beam current is 27 mA with a pulse width of 35 lts. The typical beam diameter is 3 mm. The instrumentation consists of three beam position monitors (BPM), a wire scanner, beam loss monitors (BLM), a slit and collector emittance measurement unit (EMU), a current toroid, and a Faraday cup. The instruments were designed to accommodate high current densities, have a large dynamic range with moderate bandwidths, and fit congested spaces.

22046 (SSCL-Preprint–525) **Evolution of the rf systems layout for the SSC collider rings.** Schaffer, G. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-931039–4: 6. workshop on RF superconductivity, Newport News, VA (United States), 4-8 Oct 1993). Order Number DE95011138. Source: OSTI; NTIS; INIS; GPO Dep.

This note contains information on the results of ongoing reviews concerning the basic design of the 360-MHz rf systems for the 2 x 20 TeV Superconducting Super Collider (SSC). For generation of 20-MV peak voltage per ring, with proton beams of 2 x 70 mA, several versions have been investigated: Version A (baseline design and modified baseline): 2 x 8 five-cell normalconducting cavities; Version B: 2 x 24 single-cell normalconducting cavities; and Version C: 2 x 8 or 2 x 10 single-cell superconducting cavities. For reasons of easier High Order Mode (HOM) damping, multicell cavities have been found inferior in performance when compared to single cells. Superconducting cavities have been found superior in handling transient beam loading when compared to normalconducting cavities. A threefold higher voltage, and a reduced R/Q value of superconducting cells lead to a ninefold increase in stored electromagnetic energy which, by the same factor, reduces the speed of phase changes originating from notches in the circulating beams. The theoretical possibility to operate superconducting cavities half-detuned in order to supply reactive power to the beam may also lead to considerable savings in overall power consumption. On the other hand, many challenges are involved with the use of superconducting cavities, such as the delicacy of the superconductive state, the complexity of cryostat design and operation, tuning requirements, sensitivity to vibration, and other issues.

22047 (SSCL-Preprint–551) **Interstrand resistance of SSC magnets.** Kovachev, V.T. (Superconducting Super Collider Lab., Dallas, TX (United States)); Neal, M.J.; Capone, D.W. II; Carr, W.J. Jr.; Swenson, C. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011154. Source: OSTI; NTIS; INIS; GPO Dep.

In situ interstrand resistance measurements were conducted on selected section of the inner coil of a full size (15 m) and a short (1 m) model SSC magnets. A model for evaluating single contacts resistance between two strands was developed. Using this model analyses of adjacent and non-adjacent strand contacts were performed. The interstrand resistance distribution throughout the coil was found to correlate with the quench location data as well as with the multipoles decay characteristics of the magnet. An anisotropic continuum based model for evaluation of cable eddy current losses was developed and results were compared with the experimental data.

22048 (SSCL-Preprint–557) **Resolution measurement of an Interpolating Pad Chamber in the 9 GeV/c π^- beam at BNL.** Fenker, H. (and others); Morgan, K.; Sypit, R. Superconducting Super Collider Lab., Dallas, TX (United States). 7 Mar 1994. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011036. Source: OSTI; NTIS; INIS; GPO Dep.

Results axe presented from the first test of a full size barrel prototype Interpolating Pad Chamber for the GEM central tracker in the 9 GeV/c π^- beam at the Brookhaven AGS. An average resolution of 45 μm has been achieved using electronics functionally identical to the final GEM design. Two 50 mRad stereo pad layers combine to give 680 μm resolution in the direction along the chamber. A calibration procedure which uses the data to measure the gains and pedestals for each pad has been developed and is presented together with resolution results from the silicon telescope used to project the tracks into the pad chambers.

22049 (SSCL-Preprint–560) **A 40 GByte/s read-out system for GEM.** Bowden, M.; Carrel, J.; Dorenbosch, J.; Kapoor, V. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011158. Source: OSTI; NTIS; INIS; GPO Dep.

The preliminary design of the read-out system for the GEM (Gammas, Electrons, Muons) detector at the Superconducting Super Collider is presented. The system reads all digitized data from the detector data sources at a Level 1 trigger rate of up to 100 kHz. A total read-out bandwidth of 40 GBytes/s is available. Data are stored in buffers that are accessible for further event filtering by an on-line, processor farm. Data are transported to the farm only as they are needed by the higher-level trigger algorithms, leading to a reduced bandwidth requirement in the Data Acquisition System.

22050 (SSCL-Preprint–568) **Ramp-rate sensitivity of SSC dipole magnet prototypes.** Devred, A.; Ogitsu, T. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1994. 129p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC35-89ER40486. Order Number DE95011162. Source: OSTI; NTIS; INIS; GPO Dep.

One of the major achievements of the magnet R&D program for the Superconducting Super Collider (SSC) is the fabrication and test of a series of 20 5-cm aperture, 15-m long dipole magnet prototypes. The ramp rate sensitivity of these magnets appears to fall in at least two categories that can be correlated to the manufacturer and production batch of the strands used for the inner-coil cables. The first category, referred to as type-A, is characterized by a strong quench current degradation at high ramp rates, usually accompanied by large distortions of the multipole fields and large energy losses. The second category, referred to as type-B, is characterized by a sudden drop of quench current at low ramp rates, followed by a much milder degradation at larger rates. The multipole fields of the type-B magnets show little ramp-rate sensitivity, and the energy losses are smaller than for the type-A magnets. The behavior of the Type-A magnets can be explained in terms of inter-strand eddy currents arising from low and non-uniform resistances at the crossovers between the strands of the two-layer Rutherford-type cable. Anomalies in the transport-current repartition among the cable strands are suggested as a possible cause for the type-B behavior. The origins of these anomalies have not yet been clearly identified. The SSC project was canceled by decision of the United States Congress on October 21, 1994.

22051 (SSC-SR–1032) **Report of the SSC workshop on distributed multipole correction coils. Task force report.** Sah, R. (ed.). Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1988. 220p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000 ; AC35-89ER40486. (CONF-8710536–Summ.: SSC workshop on distributed multipole correction coils, Upton, NY (United States), 13-14 Oct 1987). Order Number DE95011093. Source: OSTI; NTIS; GPO Dep.

The SSC Workshop on Distributed Multipole Correction Coils was held at Brookhaven National Laboratory on October 13 and 14, 1987. This Workshop was organized by the SSC Central Design Group, and its purpose was to discuss the present status of specifications, designs, and R&D plans for distributed, actively-powered multipole correction coils for the SSC. The Workshop was organized into four consecutive sessions to discuss the following topics: requirements for distributed correction coils, distributed connection coil designs, materials issues, and plans for future R&D. The following conclusions were drawn from the workshop: Accelerator physics considerations indicate that distributed multipole correction coils represent a feasible and flexible method to correct magnetic field errors in the SSC. Considerable progress has been made by Brookhaven National Laboratory in collaboration with industry to develop a possible fabrication technique for distributed correction coils. This technique consists of imbedding superconducting wire in a flexible plastic substrate. Its feasibility for the SSC still needs to be demonstrated. BNL has presented a preliminary plan for the necessary R&D. A successful technique has been developed to manufacture distributed correction coils for HERA. The coil performance is excellent. As yet, no plan has been proposed to study this type of correction coil for the SSC. The results from an experiment to study radiation damage to organic materials, although still preliminary, am providing guidance in selecting the most radiation resistant materials to use in correction coils. The test samples in this experiment were subjected to much larger radiation doses than expected at the SSC. Considerable information on radiation damage is available in the literature.

22052 (SSC-SR–1034) **SSC 17-meter dipole magnet DD000Z test results and investigation of coil failure: The report of the "Z" Committee.** Coombes, R. (ed.) (Lawrence Berkeley Lab., CA (United States)); Mirk, K.; Tompkins, J.; Zbasnik, J.; Lundy, R.; Schneider, W.; Wanderer, P. Lawrence Berkeley Lab., CA (United States). SSC Central Design Group; Fermi National Accelerator Lab., Batavia, IL (United States); Brookhaven National Lab., Upton, NY (United States). Mar 1988. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000 ; AC35-89ER40486. Order Number DE95011095. Source: OSTI; NTIS; INIS; GPO Dep.

Following the failure of the lower inner coil of magnet DD000Z on November 3, 1987, a committee was formed on November 11 and given the following charges: 'To review the events leading up to and including the failure of the coils of magnet DD000Z. The intent of the review will be to determine the cause of the failure and to make recommendations to reduce the likelihood of such failures in the future. Given the fact that this is the first long magnet to be disassembled, the committee may uncover leads which point to other opportunities for improvement. The committee should follow up on these leads. The committee should prepare a plan to serve as an initial guide for the disassembly and provide guidance as the disassembly progresses.' The committee held its first meeting at FNAL on 17 and 18 Nov to review the record of events leading up to the failure and to establish an initial disassembly procedure. This was followed by further meetings at FNAL, BNL, and CDG, leading to this final report. Committee activities included interviewing personnel who had been involved in the design, assembly and testing of DD000Z, reviewing all documents relating to the magnet and its failure, and participating in and providing guidance during the disassembly. The intention of the committee was to report factual findings, to consider well founded hypotheses, not to consider conjecture and to avoid speculation.

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Refer also to citation(s) 21888, 21897, 21914, 21918, 21937, 21942, 21961, 21995, 21998, 22104

22053 (ANL/APS/TB–22) **Magnetic measurements of the elliptical multipole wiggler prototype.** Frachon, D. (Argonne National Lab., IL (United States)); Vasserman, I.; Ivanov, P.M.; Medvedko, E.A.; Gluskin, E.; Vinokurov, N.A. Argonne National Lab., IL (United States). Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95010313. Source: OSTI; NTIS; INIS; GPO Dep.

A prototype of the elliptical multipole wiggler (EMW) has been assembled, tested, and magnetically tuned at the APS. This prototype has a period of 160 mm with seven poles for the hybrid structure (antisymmetric configuration) and ten poles for the electromagnetic part of the EMW (symmetric configuration). The hybrid structure of the EMW produces a vertical magnetic field of 0.83 T (K_y = 12) for a gap of 27 mm, and the electromagnet structure provides a maximum horizontal field of 0.12 T (K_x = 1.6) with AC frequency up to 100 Hz. The alternation time is about 3 ms. The requirements for electromagnetic field quality are very tight because the EMW introduces orbit perturbations in the vertical plane, where the emittance is smallest. Also the storage ring correction system cannot respond to perturbations of more than 10 Hz frequency. Thus the main effort during the magnetic tuning of the EMW was directed toward establishing time independence of the magnetic field integrals to better than 2 G-cm while the current was alternating through the electromagnet. This time independence has been achieved by implementing a special field integral compensation system and novel fast magnetic measurement techniques. Magnetic measurements of the EMW prototype have been performed at the APS insertion device magnetic measurement facility. A new fast acquisition system with a maximum sampling rate of 1 MHz has been developed and used for these measurements. Also a novel "twisted coil" technique has been used in order to make fast measurements of the second field integral. The field integral compensation on the order of 1 G-cm and 1,000 G-cm^2 for the first and second integrals, respectively, has been achieved at electromagnet AC frequencies up to 100 Hz.

22054 (BNL–61225) **Construction and testing of arc dipoles and quadrupoles for the relativistic heavy ion collider (RHIC) at BNL.** Wanderer, P. (and others); Muratore, J.; Anerella, M. Brookhaven National Lab., Upton, NY (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–137: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011813. Source: OSTI; NTIS; INIS; GPO Dep.

The production run of superconducting magnets for the Relativistic Heavy Ion Collider (RHIC) project at Brookhaven National Laboratory (BNL) is well underway. Of the 288 arc dipoles needed

for the collider, more than 120 have been delivered. More than 150 arc quadrupoles have been delivered. All of these magnets have been accepted for RHIC. This paper reports the construction and performance of these magnets. Novel features of design and test, introduced to enhance technical performance and control costs, are also discussed. Other papers submitted to this Conference summarize work on the sextupoles and tuning quads, arc correctors, and combined corrector-quadrupole-sextupole assemblies (CQS).

22055 (BNL–61787) **Performance of the SRRC storage ring and wiggler commissioning.** Kuo, C.C. (Synchrotron Radiation Research Center, Taiwan (China)); Hsu, K.T.; Luo, G.H. Brookhaven National Lab., Upton, NY (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–102: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012082. Source: OSTI; NTIS; INIS; GPO Dep.

A 1.3 GeV synchrotron radiation storage ring at SRRC has been operated for more than a year since October 1993. Starting from April 1994, the machine has been open to the user community. In February 1995, the authors installed a wiggler magnet of 1.8 tesla 25-pole in the ring and successfully commissioned. The machine was scheduled for the users' runs from the middle of April this year. The authors describe the performance of the machine without wiggler magnet system and then report the wiggler effects on the beam dynamics of the storage ring, e.g., tune shift, beta-beating, orbit change, nonlinear dynamics effect, etc. Some measurements are compared with the model prediction and agreement between them was fairly good. Possible actions to minimize wiggler effects have been taken, such as orbit correction as a function wiggler gap change. The machine improvement projects, such as longitudinal and transverse damping systems as well as orbit stability feedback system are under construction and will be in use soon.

22056 (FNAL/C–95/100) **2 × 2 TeV $\mu^+\mu^-$ collider: Lattice and accelerator-detector interface study.** Gelfand, N.M.; Mokhov, N.V. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–202: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013238. Source: OSTI; NTIS; INIS; GPO Dep.

The design for a high-luminosity $\mu^+\mu^-$ superconducting storage ring is presented based on first-pass calculations. Special attention is paid to two Iowa interaction regions (IR) whose optics are literally interlaced with the collider detectors. Various sources of backgrounds in IR are explored via realistic Monte Carlo simulations. An improved design of the collider lattice in the neighborhood of the interaction points (EP) is determined by the need to reduce significantly background levels in the detectors.

22057 (INIS-RU–405, pp. 378-381) **Longitudinal polarization studies for VEPP-4M.** Shatilov, D.N.; Zholents, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of spin at VEPP-4M storage ring is considered. The scheme comprises the solenoid and three quadrupole lenses placed at both sides of the solenoid. It is shown, that using such spin rotation scheme a high degree of longitudinal polarization at VEPP-4M can be obtained in the energy of γ(1S) resonance. 7 refs.

22058 (JINR–94-1, pp. 88-89) **Tau-charm factory - accelerator studies.** Aleksandrov, V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Anosov, V.; Antropov, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. LINEAR COLLIDERS/particle production; LINEAR COLLIDERS/tau particles; BEAM LUMINOSITY; COLLIDING BEAMS; FEASIBILITY STUDIES; FLOWSHEETS; GEV RANGE 01-10

22059 (SLAC–95-6788) **Trapped macroparticles in electron storage rings.** Zimmermann, F. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Seeman, J.T.; Zolotorev, M.; Stoeffl, W. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–186: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014652. Source: OSTI; NTIS; INIS; GPO Dep.

Sudden drops of the beam lifetime ascribed to the capture of positively charged macroparticles ('dust') are observed at many high-energy electron storage rings. A trapped macroparticle has a certain thermal lifetime due to energy transfer from the beam; the interplay of different ionizing and discharging processes gives rise to an equilibrium charge. The beam lifetime is reduced by bremsstrahlung both in the field of the atomic nuclei and in the macroscopic field of the highly charged dust particle. Recent observations at some storage rings can be explained by the capture of a single macroparticle of about micron size, possibly made from silicon dioxide. In the two B factories under construction, PEP-II and TRISTAN-II, trapped macroparticles will be thermally unstable and explode after a few tens of microseconds, thanks to the much higher beam current as compared with other storage rings.

22060 (SLAC–451, pp. 132-155) **A Tau-Charm Factory at BEPC (Preliminary design and parameters).** Wu, Yingzhi (IHEP, Beijing (China)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author presents a preliminary design of how a Tau Charm Factory could be added to the Beijing Electron Positron Collider (BEPC) facility. The design is offered independent of the issue of funding, which the facility would need outside help to accomplish. Included in the design are specifications for the storage rings, siting, and design goals.

22061 (SLAC–451, pp. 399-436) **Summary of the Marbella TCF Workshop.** Kirkby, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper the author reviews the third workshop on the Tau-Charm Factory, held in Marbella, Spain, on 1-6 June 1993. The aim of the conference was: a thorough review of physics interest in light of recent theoretical and experimental progress; to update designs of accelerators and detectors for such a machine; and to discuss plans for the realization of such a device. The conclusions were that such a device would allow precision study of electroweak physics in tau systems. It would allow comprehensive study of tau and charm systems. It would be complementary to a B factory, providing in general better statistics with lesser systematic effects, and precision charm data for use in B factories. The device and its detector are feasible to design and construct.

22062 (SLAC–451, pp. 437-450) **A Tau-Charm Factory at Argonne.** Repond, J. (Argonne National Lab., IL (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a preliminary proposal from Argonne National Laboratory for a Tau Charm Factory. The authors argue that APS provides potential facilities, expertise in colliders, expertise in detectors from the HEP section of Argonne, a major laboratory with no major projects on line at present, and a potentially attractive project. The report points out that even in the face of the present

design proposal, actual work on such a device requires support for a facility from the HEP community, ANL management, and DOE.

22063 (SLAC–451, pp. 451-464) **JINR studies for a Tau-Charm Factory.** Chelkov, G. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR*. 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This paper touches on work being done a JINR relevant to a proposal for construction of a tau charm factory, and its attendant detector system. A workshop on such a device was held at JINR in 1992, and here the author touches on questions of what one wants to learn about tau particles from such a machine, the charge to the group looking at a detector design for such a facility, the general conclusions of the JINR study, and a status report of work on the JINR Tau Charm Factory project.

22064 (SLAC-PUB–95-6795) **Transverse EM fields in a detuned X-band accelerating structure.** Heifets, S.A.; Kheifets, S.A.; Woo, B. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–196: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014657. Source: OSTI; NTIS; INIS; GPO Dep.

Results are presented of a study of the dipole EM fields in detuned accelerating sections excited by a point-like bunch. The transverse coupling impedance, the kick factors, and the wake functions are found.

22065 (SLAC-PUB–95-6797) **Pressure stability under a pump failure.** Heifets, S.A. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Seeman, J.; Stoeffl, W. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–185: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014647. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. PEP STORAGE RINGS/pressure dependence; INELASTIC SCATTERING; BEAM TRANSPORT; BEAM CURRENTS; CROSS SECTIONS; IONIZATION; PRESSURE GRADIENTS; INSTABILITY

22066 (SLAC-PUB–95-6886) **The effect of phase advance errors between interaction points on beam halos.** Chen, T.; Irwin, J.; Siemann, R.H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–94: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012559. Source: OSTI; NTIS; INIS; GPO Dep.

Phase advance errors between interaction points (IP) break the symmetry of multi-IP colliders. This symmetry breaking introduces new, lower order resonances which may chance the halo from the beam-beam interaction dramatically. In this paper, the mechanism of introducing new resonances is discussed. Simulation results showing the changes due to phase advance errors are presented. Simulation results are compared with experimental measurements at VEPP-2M.

22067 (SLAC-PUB–95-6887) **Studies of halo distributions under beam-beam interaction.** Chen, T.; Irwin, J.; Siemann, R.H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–95: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012560. Source: OSTI; NTIS; INIS; GPO Dep.

The halo distribution due to the beam-beam interaction in circular electron-positron colliders is simulated with a program which uses a technique that saves a factor of hundreds to thousands of CPU time. The distribution and the interference between the beam-beam interaction and lattice nonlinearities has been investigated. The effects on the halo distribution due to radiation damping misalignment at the collision point, and chromatic effect are presented.

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22068 (LA-SUB–94-63) **Fiber optic and sensor technology support. Project progress report.** Day, G.W. Los Alamos National Lab., NM (United States); National Inst. of Standards and Technology (NEL), Boulder, CO (United States). Electromagnetic Technology Div. Oct 1988. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011063. Source: OSTI; NTIS; GPO Dep.

This briefly summarizes the work done under contract during FY88. The major technical development of the year has been substantial progress in reducing the size of fiber current sensors. The authors have continued the study of the ZnSe magnetic field sensor started last year. They have continued to investigate the possibility of obtaining fibers that would have better properties for magnetic field or current sensing. They investigated a high speed, polarization independent, switch that could be useful for LANL instrumentation applications. They have constructed the fixtures for an experiment to study the Kerr electro-optic effect in optical fiber. The have done some exploratory work on electro-optic deflection, with a view to possible infrared streak camera applications. They have made significant progress, primarily on another contract, in construction techniques that will yield more rugged sensors. They have continued to study bismuth germanate as an electro-optic material. They have continued to provide general support on a wide range of fiber and sensor problems. This has been carried out through visits of NIST staff to LANL and NTS, visits of LANL staff to NIST, numerous phone consultations and participation in technical meetings of particular interest. This year, they participated in and made presentations based on NIST/LANL collaborations at the annual Photonics Workshop, the first DoD Fiber Optics Conference, and the annual SPIE fiber Sensor Symposium. In addition, they have visited companies and attended other conferences and exhibitions to obtain information on new products and techniques that could be of use to LANL staff.

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Refer also to citation(s) 21023, 21605, 21747, 21965, 22013, 22018, 22036, 22040, 22048, 22049, 22061, 22063, 22240, 22271, 22409, 22460, 22616, 22641, 22649, 22692

22069 (ANL-HEP-PR–95-8) **Development of a parallel plate proportional counter TRD with suppressed sensitivity to ionization.** Solomey, N. (Chicago Univ., IL (United States). Enrico Fermi Inst.); Krolak, P.; Graham, G.; Dawson, J.W. Argonne National Lab., IL (United States). 3 Feb 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950276–2: 7. Vienna wire chamber conference (WCC-95), Vienna (Austria), 13-17 Feb 1995). Order Number DE95009919. Source: OSTI; NTIS; INIS; GPO Dep.

The development of a Parallel Plate Proportional Counter which has a highly suppressed sensitivity to ionization but retains a good X-ray signal to noise ratio is presented. Details of the laboratory development and actual beam tests showing the e/π rejection are described. Because of its insensitivity to ionization this type of detector can be useful in an environment where the number of minimum ionizing particles are high, but uninteresting; however, the detector is very sensitive to the highly localized electron cloud from converted X-rays making it ideal as a transition radiation X-ray detector. Thus, this detector only gives a signal for charged particles above TR threshold; all other particles below this threshold produce no TR X-rays giving only a pedestal-like signal. The system's potential performance for π/p separation in the intended neutral Hyperon experiment is evaluated.

22070 (ANL/XFD/CP–82883) **Soft x-ray scanning microtomography with submicron resolution.** McNulty, I. (Argonne National Lab., IL (United States)); Haddad, W.S.; Trebes, J.E.; Anderson, E.H. Argonne National Lab., IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC03-76SF00098 ; W-31-109-ENG-38 ; W-7405-ENG-48. (CONF-940714–55: International meeting on synchrotron radiation instrumentation, Stony Brook, NY (United States), 18-22 Jul 1994). Order Number DE95011817. Source: OSTI; NTIS; INIS; GPO Dep.

Scanning soft x-ray microtomography was used to obtain high-resolution three-dimensional images of a microfabricated test object. Using a special rotation stage mounted on the scanning transmission x-ray microscope at the XIA Beamline at the National Synchrotron Light Source, we recorded nine two-dimensional projections of the 3D test object over an angular range of −50° to +55°. The x-ray wavelength was 3.6 nm and the radiation dose to the object per projection was approximately 2 x 10^6 Gy. The object consisted of two gold patterns supported on transparent silicon nitride membranes, separated by 4.75 Jim, with 100 to 300-nm wide and 65-nm thick features. We reconstructed a volumetric data set of the test object from the two-dimensional projections using an algebraic reconstruction technique algorithm. Features of the test object were resolved to ~100 nm in transverse and longitudinal extent in three-dimensional images rendered from the volumetric set.

22071 (CEA-DAPNIA–94-08) **A Compton polarimeter for CEBAF Hall A.** Bardin, G.; Cavata, C.; Frois, B.; Juillard, M.; Kerhoas, S.; Languillat, J.C.; Legoff, J.M.; Mangeot, P.; Martino, J.; Platchkov, S.; Rebourgeard, P.; Vernin, P.; Veyssiere, C. CEBAF Hall A Collaboration. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Sep 1994. 5p. (CONF-9409103–: International symposia on high energy spin physics and polarization phenomena in nuclear physics, Bloomington, IN (United States), 15-22 Sep 1994). Order Number DE95631504. Source: OSTI; NTIS (US Sales Only); INIS.

The physic program at CEBAF Hall A includes several experiments using 4 GeV polarized electron beam: parity violation in electron elastic scattering from proton and ^{4}He, electric form factor of the proton by recoil polarization, neutron spin structure function at low Q^2. Some of these experiments will need beam polarization measurement and monitoring with an accuracy close to 4%, for beam currents ranging from 100 nA to 100 microA. A project of a Compton Polarimeter that will meet these requirements is presented. It will comprise four dipoles and a symmetric cavity consisting of two identical mirrors. 1 fig., 10 refs.

22072 (CONF-9506185–1) **Neutron scintillators using wavelength shifting fibers.** Hutchinson, D.P.; Miller, V.C.; Ramsey, J.A. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From New tools for neutron instrumentation workshop; Les Houches (France); 6-10 Jun 1995. Order Number DE95012841. Source: OSTI; NTIS; INIS; GPO Dep.

A proposed design for an optically-based, one-dimension scintillation detector to replace the gas-filled position-sensitive proportional counter currently used for a wide-angle neutron detector (WAND) at the high-Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory (ORNL) is presented. The scintillator, consisting of a mixture of ^{6}LiF and ZnS(Ag) powders in an epoxy binder, is coupled to an array of wavelength shifting optical fibers which provide position resolution. The wide-angle neutron detector is designed to cover a 120 degree arc with a 75 cm radius of curvature. The final detector design provides for 600 optical fibers coupled to the scintillator screen with an angular resolution of 0.2 degrees. Each individual pixel of the detector will be capable of operating at count rates exceeding 1 MHz. Results are presented from the measurement of neutron conversion efficiencies for several screen compositions, gamma-ray sensitivity, and spatial resolution of a 16 element one-dimensional array prototype.

22073 (FEI–2392) **Possibilities of improvement of the DIN-2K spectrometric complex performances.** Novikov, A.G.; Puchkov, A.V.; Stupak, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 35p. (In Russian). Order Number DE95633646. Source: OSTI; NTIS (US Sales Only); INIS.

The detailed calculations of the neutron spectrometers DIN-2PI and DIN-2PR characteristics for the various modes of their operation are given. The comparison of these instruments with foreign analogous and the possible ways to improve their characteristics are discussed. 16 refs.; 7 figs.; 12 tabs.

22074 (FEI–2397) **Measurement of radiation multiplicity spectra and alpha value for uranium-235.** Grigor'ev, Yu.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst.); Georgiev, G.P.; Stanchik, Kh. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 16p. (In Russian). Order Number DE95633647. Source: OSTI; NTIS (US Sales Only); INIS.

Gamma-spectra from 1 to 12 multiplicity were measured on the 500 m flight path of the IBR-30 by means a 16-section scintillation detector with a NaJ(Tl) crystals of a volume of 321 for two metallic samples of thickness 0.00137 a/b and 0.00411 a/b with 90%-uranium-235 and 10%-uranium-238. Spectra of multiplicity were obtained for reserved resonances in the region of energy E=1-150 eV. They were used for determination of the value $\alpha=\sigma_\gamma/\sigma_f$ for 165 resonances of uranium-235. 6 refs.; 8 figs.; 1 tab.

22075 (FNAL/C–95/086) **Review of calorimetry in Fermilab fixed-target experiments.** Crisler, M.B. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9410317–3: IHEP: 1994 Beijing calorimetry symposium, Beijing (China), 25-27 Oct 1994). Order Number DE95013001. Source: OSTI; NTIS; INIS; GPO Dep.

The fixed-target program at Fermilab comprises as many as thirteen simultaneous experiments in ten separate beamlines using beams of primary protons, pions, kaons, electrons, neutrinos, and muons. The fixed target beamlines were last in operation in the latter half of 1991, shutting down in 1992. The next fixed target run is scheduled for early 1996. This article describes some of the wide variety of calorimetric devices that were in use in the past run or to be used in the coming run. Special attention is devoted to the new devices currently under construction.

22076 (FNAL/C–95/110) **FOCEX: A fiber-optic extender for a high speed parallel RS485 data cable.** Meadows, J.T. (Fermi National Accelerator Lab., Batavia, IL (United States)); Anderson, J.T.; Cooper, P.S.; Engelfried, J.; Franzen, J.W.; Forster, B.G.; Levinson, F.; Rawls, J.; Haber, S. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950534–1: Conference on real-time computer applications in nuclear, particle and plasma physics (RT), East Lansing, MI (United States), 22-26 May 1995). Order Number DE95012968. Source: OSTI; NTIS; INIS; GPO Dep.

For longer-distant, high speed data links, optical fibre becomes most cost-effective than copper or other hard wire cable systems. Fermilab supplied to Finisar Corp. of Menlo Park, CA., a set of specifications for card functions, sizes and interconnector pin assignments. Finisar designed and assembled a set of fiber optical P.C. cards using 100 megabyte/sec commercial optoelectronics and a serialization and deserialization HOT-ROD chipset designed by GAZELLE Microcircuits, Inc. (A Tri Quint Semiconductors company). The cooperative effort between Fermilab and Finisar has allowed Fermilab to created a reliable 50 Megabytes/sec (40 bit parallel RS485 DART data bus) cable to cable extender using a virtually invisible Fiber Channel point-to-point(FC-0) fiber optical single-simplex system. The system is easily capable of sustaining a 50 megabytes/sec of data, control and status line throughput at distances of 1625 feet (500 meters) using standard multi-mode fiber.

22077 (INIS-JP–028, pp. 36-37) **Measurement of pulse height defect in silicon surface-barrier detectors. 3.** Kanazawa, Satoshi (Kyoto Univ. (Japan). Faculty of Engineering); Kanno, Ikuo; Kimura, Itsuro; Ichihara, Chihiro; Hayashi, S.A. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1993. 156p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Faculty of Engineering, Kyoto University*. Order Number DE95709897. Source: OSTI; NTIS; INIS.

The recombination effect in the residual defect of a silicon surface barrier detector was investigated for low energy heavy ions (below 0.2 MeV/amu). The recombination effect had -1/2 power dependence on the electric field strength. It was also found that the

plasma column with higher electron-hole density had less recombination effect, contrary to the case of high energy heavy ions (above 1 MeV/amu). (author).

22078 (INIS-JP–029, pp. 136-137) **Development of NiGe(Pd) Ohmic contacts to n-type GaAs.** Furumai, Masaki (Kyoto Univ. (Japan). Faculty of Engineering); Wakimoto, Hiroki; Oku, Takeo; Murakami, Masanori. Kyoto Univ. (Japan). Faculty of Engineering. Jul 1994. 163p. (In Japanese). In *Annual report of Radiation Laboratory Department of Nuclear Engineering Kyoto University for fiscal 1993.* Order Number DE95709896. Source: OSTI; NTIS; INIS.

Contact resistances of NiGe Ohmic contacts were reduced by adding a small amount of Pd to the NiGe contacts. These contacts had smooth surface and shallow diffusion depth. A model for the current transport of the NiGe(Pd) Ohmic contacts was proposed, which explained well the dependencies of the contact resistances on the microstructure at the GaAs/metal interface. (author).

22079 (INIS-mf–14548, pp. 15-23) **The SSDL Argentina - Ready to provide TLD intercomparison service for hospitals in Latin-America.** Saravi, M. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Papadopulos, S.; Mugliaroli, H. International Atomic Energy Agency, Vienna (Austria); World Health Organization, Geneva (Switzerland). Dec 1993. 27p. In *SSDL Newsletter. No.32.* Order Number DE95633405. Source: OSTI; NTIS (US Sales Only); INIS.

Thermoluminescence dosimeters (TLD) are widely used to verify absorbed dose delivered from radiation therapy beams. The Secondary Standard Dosimetry Laboratory (SSDL) of Argentina uses TLD for its mailed dose intercomparison programme for cobalt 60 radiation therapy units. The method and technique employed by the SSDL are analyzed. In 1992 and 1993 the SSDL participated in the IAEA Quality Control Programme for the TLD postal dose intercomparison service of this laboratory. The results of the QC Programme indicate that the dose evaluated by the SSDL TLD service for participant centers is about 1% lower than that evaluated by the IAEA TLD service. This deviation is accepted taking into account that a $\pm$ 2% dose uncertainty for TLD dosimetry is reasonable. (author). 5 refs, 3 figs, 4 tabs.

22080 (INIS-RU–405, pp. 367-370) **The target polarization measurement system with a phase shift detectors A-meter.** Bazhanov, N.A.; Efimovykh, B.A.; Kovalev, A.I.; Murzin, V.I.; Shchedrov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The system of NMR spectrum registration for target polarization measurement is described. The system consists of an oscillator of the Q-meter, the voltage-to-code converters, the phase detector and the controlled phase rotator. The system was controlled by minicomputer through CAMAC units. The equilibrium deuteron absorption spectrum obtained by means of this system is presented for T=0.73 K and f=15.82 MHz. 4 refs.

22081 (INIS-RU–405, pp. 371-377) **The possible method of beam polarization measurement on high energy electron-positron linear colliders.** Ptitsyn, V.I.; Shatunov, Yu.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The method of beam polarization measurement on high-energy electron-positron linear colliders is proposed. It is based on the effect of spatial separation of electrons or positrons moving in homogeneous magnetic field and having opposite spin projection on the field direction. The method can be employed in linear colliders with energies up to 1000 GeV. 3 refs.

22082 (JINR–94-1, pp. 36-37) **Study of the cumulative fragmentation of the deuteron in the exclusive polarization approach and of the subthreshold kaon production at the synchrotron COSY.** Komarov, V.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Zalikhanov, B.Zh.; Akimov, Yu.K. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs., 1 fig. DRIFT CHAMBERS/kaon detection; HODOSCOPES/kaon detection; SCINTILLATION COUNTERS/kaon detection; BENCH-SCALE EXPERIMENTS; COMPUTERIZED SIMULATION; GEV RANGE 01-10; HODOSCOPES

22083 (JINR–94-1, pp. 38-39) **Precise measurement of the probability of the $\pi^+ \to \pi^0 e^+ \nu_e$ decay.** Kuchinskij, N.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Karpukhin, V.V.; Korenchenko, S.M.; Kravchuk, N.P.; Korenchenko, A.S.; Khomutov, N.V.; Baranov, V.A.; Moiseenko, A.S.; Smirnov, V.V.; Yakovlev, S.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. MULTIWIRE PROPORTIONAL CHAMBERS/particle decay; MULTIWIRE PROPORTIONAL CHAMBERS/pion detection; ACCURACY; ELECTRON NEUTRINOS; FLOWSHEETS; PARTICLE IDENTIFICATION; PERFORMANCE; PIONS NEUTRAL; PIONS PLUS; POSITRONS; READOUT SYSTEMS

22084 (JINR–94-1, pp. 44-45) **Search for double beta-decay of ^{100} Mo.** Vylov, Ts. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Brudanin, V.; Rukhadze, N. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs., 4 figs. BETA SPECTROMETERS/double beta decay; ENERGY RESOLUTION; FLOWSHEETS; GEIGER-MUELLER COUNTERS; HIGH-PURITY GE DETECTORS; MEV RANGE 01-10; MOLYBDENUM 100; PERFORMANCE; PLASTIC SCINTILLATION DETECTORS; TIME RESOLUTION

22085 (JINR–94-1, pp. 46-47) **Search for the decay $K^+ \to \pi^+ \mu^+ e^-$.** Zalikhanov, B.Zh. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Rudenko, A.I.; Lebedev, N.A.; Kurbatov, V.S.; Komossarov, E.V.; Artemov, V.M.; Yashenko, C.V.; Korenchenko, S.M.; Kravchuk, N.P.; Korenchenko, A.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. DRIFT CHAMBERS/muon detection; DRIFT CHAMBERS/particle identification; ELECTRONS; KAONS PLUS; MUONS PLUS; PARTICLE DECAY; PERFORMANCE; PIONS PLUS

22086 (JINR–94-1, pp. 48-49) **Direct measurement of the branching ratio for the decay of the η-meson into two photons.** Ehfendiev, A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Lytkin, L.; Boudard, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. BGO DETECTORS/gamma detection; SHOWER COUNTERS/gamma detection; BRANCHING RATIO; ETA MESONS; FLOWSHEETS; GAMMA SPECTRA; MEV RANGE 100-1000; PARTICLE DECAY; PHOTONS

22087 (JINR–94-1, pp. 62-63) **The Delphi detector (detector with lepton, photon and hadron identification).** Alekseev, G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation).

Lab. of Nuclear Problems); Bilenky, M.; Chelkov, G. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. SHOWER COUNTERS/particle identification; STREAMER SPARK CHAMBERS/particle identification; FLOWSHEETS; HADRONS; LEPTONS; PHOTONS

22088 (JINR–94-1, pp. 68-69) **Search for the oscillation $\nu_\mu \rightleftarrows \nu_\tau$.** Batusov, Yu. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bunyatov, S.; Klimov, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs., 2 figs. DRIFT CHAMBERS/neutrino oscillation; SHOWER COUNTERS/neutrino oscillation; TRANSITION RADIATION DETECTORS/neutrino oscillation; COMPUTERIZED SIMULATION; FLOWSHEETS; GEV RANGE 01-10; MIXING RATIO; MUON NEUTRINOS; TAU NEUTRINOS

22089 (JINR–94-1, pp. 84-85) **Solenoidal detector collaboration.** Budagov, Y.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Chirikov-Zorin, I.E.; Churin, I.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. SHOWER COUNTERS/superconducting magnets; FLOWSHEETS; HADRONS; SOLENOIDS

22090 (JINR–94-1, pp. 86-87) **General-purpose pp experiment at the Large Hadron Collider at CERN.** Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. SHOWER COUNTERS/hadrons; SHOWER COUNTERS/muon detection; BENCH-SCALE EXPERIMENTS; PERFORMANCE TESTING; HADRONS; SOLENOIDS; SPATIAL RESOLUTION; SUPERCONDUCTING MAGNETS

22091 (JINR–94-1, pp. 90-91) **Detector for C-tau factory of the JINR storage accelerator complex.** Azhgirej, L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bannikov, A.; Barabash, L. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 figs. BGO DETECTORS/tau particles; SHOWER COUNTERS/tau particles; SPARK COUNTERS/tau particles; GEV RANGE 01-10; PARTICLE PRODUCTION; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE 0065-0273 K; TEMPERATURE RANGE 0273-0400 K; TIMING PROPERTIES

22092 (JINR–94-1, pp. 94-95) **Development of technology for production of silicon aerogel and construction of Cherenkov counters based on it.** Akimov, Yu.K. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Zrelov, V.P.; Komarov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. CHERENKOV COUNTERS/fabrication; CHERENKOV COUNTERS/silicon oxides; AUTOCLAVES; FABRICATION; GELS

22093 (JINR-D–13-94-478) **Stereoscopic Meso-Optical Fourier Transform Microscope with Double Focusing.** Batusov, Yu.A.; Soroko, L.M.; Tereshchenko, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. 12p. Order Number DE95632458. Source: OSTI; NTIS (US Sales Only); INIS.

The construction of the stereoscopic meso-optical Fourier transform microscope (MFTM) with double focusing for particle tracks of low ionization level in the nuclear emulsion is described. It is shown that in the stereoscopic prototype of the MFTM with double focusing there is no ambiguity in the interpretation of the data about the (x,z)-coordinates of the particle track. The experimental error of the orientation angle $\theta_{x,y}$ is as low as 1,5' (angular minute). The data gathered over the length of the particle track 6 mm enables us to check the genetic unity of the particle tracks going from the vertex point, to fix the small angle scattering events and to isolate some local geometrical distortions in the nuclear emulsion. 3 refs., 11 figs.

22094 (JINR-E–4-94-123, pp. 103) **Silicon detectors with avalanche intrinsic amplification.** Kashevarov, V.L. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.); Pavlyuchenko, L.N.; Sokol, G.A.; Zalessky, V.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. SI SEMICONDUCTOR DETECTORS; SIZE; SPATIAL RESOLUTION; TIME RESOLUTION; TOWNSEND DISCHARGE

22095 (JINR-E–13-94-502) **Investigation of the Geometrical Distortions in the Nuclear Emulsion.** Batusov, Yu.A.; Rumyantseva, V.P.; Soroko, L.M.; Tereshchenko, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. 14p. Order Number DE95631509. Source: OSTI; NTIS (US Sales Only); INIS.

The geometrical distortions in the nuclear emulsion were investigated by means of two devices: (1) stereoscopic meso-optical Fourier transform microscope (MFTM) and (2) traditional optical microscope (KSM-1) designed for precise measurements. The particle tracks were produced by primary Oxygen-nuclei with impulse 65.6 GeV/c and by secondary α-particles in various regions of the nuclear emulsion. The measurement errors were: 1.8' (angular minute) for orientation angle θ_{xy}; 2.7' (angular minute) for dip angle θ_z; 0.3 μm for transverse coordinate x; 0.1 μm for longitudinal coordinate y and 0.3 μm for depth coordinate z. The effect of the global forced bending of the nuclear emulsion glass support was detected and estimated as $d\theta_z/dy$=2' (angular minute) per mm. To suppress the local geometrical distortions, a difference plot was calculated for two secondary α-particles going very close within $\leq$ 10 μm over the distance 6 mm. It was shown that this mode of the local geometrical distortions is kept constant over the mutual transverse distances up to 0.6 mm. By observing the zy-plots of four secondary α-particles we have isolated the rotating mode of the local geometrical distortions in the nuclear emulsion. 5 refs., 11 figs.

22096 (LA-UR–95-324) **Gamma-ray spectroscopy of in-situ SNM with the M^{3}CA and a new room-temperature detector.** Russo, P.A.; Close, D.A.; Hsue, S.T.; Sprinkle, J.K. Jr.; Sumner, M.C. Los Alamos National Lab., NM (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950923–2: 5. international conference on facility-safeguards interface, Jackson Hole, WY (United States), 24-30 Sep 1995). Order Number DE95006278. Source: OSTI; NTIS; GPO Dep.

Compact, rugged, efficient, and reliable room-temperature gamma ray detectors with better energy resolution are need for in situ applications. These improved detectors are sought as alternatives to the compact NaI(T1) detectors now available. A promising approach is an elegant new design that benefits fully form the recent advances in solid-state materials technology for production of large, good quality crystals of CdZnTe for room-temperature gamma ray spectroscopy. The new detector, equipped with simple but innovative electrode technology to address intrinsic charge-collection deficiencies, operates with the new self-contained portable gamma spectroscopy system, the miniature modular multichannel analyzer (M^{3}CA), without added layers of electronic complexity for pulse processing. Applications of in situ NDA for

portable determinations of fixed uranium and plutonium quantities and the continuous assay of dynamic quantities of these materials will provide the test criteria for evaluating the performance of such detectors operating with the M^3CA.

22097 (LA-UR-95-1564) **Nonproliferation and safeguarding via ionization detection.** Koster, J.E.; Johnson, J.P.; Steadman, P. Los Alamos National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512-151: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011974. Source: OSTI; NTIS; INIS; GPO Dep.

A significant signature of the presence of special nuclear material (SNM) is ionizing radiation. SNM naturally decays with the emission of alpha particles, gamma rays, and neutrons. Detecting and monitoring these emissions is an important capability for international safeguards. A new detection method collects the ions produced by such radiation in ambient air. Alpha particles in particular are specific to heavy nuclei but have very short range. The ions produced by an alpha, however, can be transported tens of meters to an ion detector. These new monitors are rugged, very sensitive, respond in real time, and in most cases are quite portable.

22098 (LBL-36711) **A superconducting linear motor drive for a positive displacement bellows pump for use in the g-2 cryogenics system.** Green, M.A. Brookhaven National Lab., Upton, NY (United States); Lawrence Berkeley Lab., CA (United States). Oct 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ; AC03-76SF00098. (CONF-941013-40: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012323. Source: OSTI; NTIS; INIS; GPO Dep.

Forced two-phase cooling of indirectly cooled magnets requires circulation of liquid helium through the magnet cooling channel. A bellows helium pump is one possible way of providing helium flow to a magnet cooling system. Since the bellows type of helium pump is immersed in liquid helium, a superconducting linear motor drive appears to be an attractive option. This report describes a linear motor drive that employs oriented permanent magnet materials such as samarium-cobalt as the stator magnet system and a superconducting loud speaker voice coil type of drive as the armature of the linear motor. This report examines drive motor requirements for a helium pump.

22099 (LBL-36908) **Development of silicon drift detectors for strangeness measurements.** Odyniec, G.; Krieger, B.; Krofcheck, D.; Lewak, D.; O'Donnel, R.; Partlan, M.; Walton, J.T.; Wang, N.W. Lawrence Berkeley Lab., CA (United States). Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950172-3: Strangeness in hadronic matter conference, Tucson, AZ (United States), 3-7 Jan 1995). Order Number DE95012366. Source: OSTI; NTIS; INIS; GPO Dep.

Detection of multi-strange and charm particles requires precise measurements of the secondary vertices close to the interaction point and the decay products of strange and charm particles. This presents an unprecedented challenge for relativistic heavy ion experiments, where multiplicity reaches thousands of final state particles per collision. Development of affordable technology for realizing high spatial resolution and low mass vertex detectors has become the ultimate goal of many R&D projects in major laboratories. In this paper we present preliminary results on silicon drift detectors fabricated for the first time on p-type silicon substrates. These detectors were designed, fabricated and tested recently at LBL and show very interesting properties which make their use in future experiments very likely.

22100 (LBL-37096) **Detection of charged particles and X-rays by scintillator layers coupled to amorphous silicon photodiode arrays.** Jing, T. (Lawrence Berkeley Lab., CA (United States)); Drewery, J.; Hong, W.S.; Lee, H.; Kaplan, S.N.; Perez-Mendez, V.; Goodman, C.A.; Wildermuth, D. Lawrence Berkeley Lab., CA (United States). Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950412-13: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95012375. Source: OSTI; NTIS; INIS; GPO Dep.

Hydrogenated amorphous silicon (a-Si:H) p-i-n diodes with transparent metallic contacts are shown to be suitable for detecting charged particles, electrons, and X-rays. When coupled to a suitable scintillator using CsI(Tl) as the scintillator we show a capability to detect minimum ionizing particles with S/N ~20. We demonstrate such an arrangement by operating a p-i-n diode in photovoltaic mode (reverse bias). Moreover, we show that a p-i-n diode can also work as a photoconductor under forward bias and produces a gain yield of 3-8 higher light sensitivity for shaping times of 1 μs. n-i-n devices have similar optical gain as the p-i-n photoconductor for short integrating times ($< 10\mu$s). However, n-i-n devices exhibit much higher gain for a long term integration (10ms) than the p-i-n ones. High sensitivity photosensors are very desirable for X-ray medical imaging because radiation exposure dose can be reduced significantly. The scintillator CsI layers we made have higher spatial resolution than the Kodak commercial scintillator screens due to their internal columnar structure which can collimate the scintillation light. Evaporated CsI layers are shown to be more resistant to radiation damage than the crystalline bulk CsI(Tl).

22101 **Gamma radiation detector.** Hofstetter, K.J. To Dept. of Energy. 1993. Filed date 4 Jan 1993. U.S. Patent Application 8-000,309. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95009952. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of a radiation detector and a radioluminescent composition for use therein. The detector includes a radioluminescent composition that emits light in a characteristic wavelength region when exposed to gamma radiation, and means for detecting said radiation. The composition contains a scintillant such as anglesite ($PbSO_4$) or cerussite ($PbCO_3$) incorporated into an inert, porous glass matrix via a sol-gel process. Particles of a radiation-sensitive scintillant are added to a sol solution. The mixture is polymerized to form a gel, then dried under conditions that preserve the structural integrity and radiation sensitivity of the scintillant. The final product is a composition containing the uniformly-dispersed scintillant in an inert, optically transparent and highly porous matrix. The composition is chemically inert and substantially impervious to environmental conditions including changes in temperature, air pressure, and so forth. It can be fabricated in cylinders, blocks with holes therethrough for flow of fluid, sheets, surface coatings, pellets or other convenient shapes.

22102 (PNL-SA-20757) **Sensitivity of LDEF foil analyses using ultra-low background germanium vs. large NaI(Tl) multidimensional spectrometers.** Reeves, J.H.; Arthur, R.J.; Brodzinski, R.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9206240-3: 2. Long Duration Exposure Facility (LDEF) post-retrieval symposium, San Diego, CA (United States), 1-5 Jun 1992). Order Number DE95011491. Source: OSTI; NTIS; INIS; GPO Dep.

Cobalt foils and stainless steel samples were analyzed for induced ^{60}Co activity with both an ultra-low background germanium gamma-ray spectrometer and with a large NaI(Tl) multidimensional spectrometer, both of which use electronic anticoincidence shielding to reduce background counts resulting from cosmic rays. Aluminum samples were analyzed for ^{22}Na. The results, in addition to the relative sensitivities and precisions afforded by the two methods, are presented.

22103 (SAND-95-1087C) **An "exact" treatment of self-shielding and covers in neutron spectra determinations.** Griffin, P.J.; Kelly, J.G. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950716-2: 32. annual IEEE international nuclear and space radiation effects conference, Madison, WI (United States), 17-21 Jul 1995). Order Number DE95013023. Source: OSTI; NTIS; INIS; GPO Dep.

Most neutron spectrum determination methodologies ignore self-shielding effects in dosimetry foils and treat covers with an exponential attenuation model. This work provides a quantitative analysis of the approximations in this approach. It also provides a methodology for improving the fidelity of the treatment of the dosimetry sensor response to a level consistent with the user's spectrum characterization approach. A library of correction functions for the energy-dependent sensor response has been compiled that addresses dosimetry foils/configurations in use at the Sandia National Laboratories Radiation Metrology Laboratory.

22104 (SLAC-PUB–95-6890) **Detector solenoid compensation in the PEP-II B-Factory.** Nosochkov, Y. (Stanford Univ., CA (United States). Stanford Linear Accelerator Center); Cai, Y.; Irwin, J.; Sullivan, M.; Forest, E. Stanford Linear Accelerator Center, Menlo Park, CA (United States); Lawrence Berkeley Lab., CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ; AC03-76SF00098. (LBL–37227; CONF-950512–97: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95012562. Source: OSTI; NTIS; INIS; GPO Dep.

The PEP-II experimental detector includes a strong 1.5 T solenoid field in the interaction region (IR). With the fringe fields, the solenoid extends over a range of 6 m. Additional complications are that (1) it is displaced longitudinally from the interaction point (IP) by about 40 cm, (2) neither beam is parallel to the solenoid axis, and (3) the solenoid overlaps a dipole and a quadrupole on either side of the IP. In each half IR the correction system includes a set of skew quadrupoles, dipole correctors and normal quadrupoles to independently compensate the coupling, orbit perturbation, dispersion and focusing effect produced by the solenoid. The correction schemes for the Low Energy Ring (LER) and for the High Energy Ring (HER) are described, and the impact on the dynamic aperture is evaluated.

22105 (SSCL-Preprint–256) **Overview of the GEM muon system cosmic ray test program at the SSCL.** Milner, E.C. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–116: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011115. Source: OSTI; NTIS; INIS; GPO Dep.

Muon track resolution exceeding 75-μm per plane is one of the main strengths of the GEM detector design, and will be crucial in searches for Higgs Bosons, heavy Z-Bosons, technicolor, and supersymmetry. Achieving this resolution coal requires improved precision in muon chambers and their alignment. A cosmic ray test stand known as the Texas Test Rio, (TTR) has been created at the SSCL for studying candidate GEM muon chamber technologies. Test results led to selecting Cathode Strip Chambers (CSC) as the GEM muon system baseline chamber technology.

22106 (UCRL-ID–120664) **Calibration of density logs at the Nevada Test Site.** Hearst, J.R. Lawrence Livermore National Lab., CA (United States). Apr 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012481. Source: OSTI; NTIS; GPO Dep.

During the evaluation of a proposed site for an underground nuclear test at the Department of Energy's Nevada Test Site (NTS) it was important to measure the bulk density of the geological formation in which the test was to be executed. The most satisfactory method for this measurement is the density log. This is a measurement system in which a gamma-ray source and detector are mounted in an instrument (a sonde) which is lowered into a borehole by a multi-conductor cable, and the number of gamma rays detected is used to infer the bulk density. At NTS many of the boreholes of interest are air-filled, with diameters as large as 3.65 m, drilled in partially-saturated media. Consequently the commercial equipment and calibration procedures are not suitable for NTS conditions. The count rate from a density sonde is strongly affected by any gap between the sonde and the borehole wall, especially if the gap is filled with air rather than water. Modern commercial density logs employ two detectors, and use one of the detectors to compensate for borehole conditions such as mudcake and gap. The commercial compensation algorithms assume that the sonde is parallel to the borehole wall; a reasonable assumption for oilfield conditions but not for NTS conditions. Moreover, in an air-filled borehole, borehole diameter affects both the calibration and the compensation. Therefore we could not use commercial algorithms to deal with NTS conditions. For many years, no appropriate two-detector algorithm was available for the NTS situation. Consequently we developed special algorithms for a single-detector sonde, which was equipped to measure the gap directly. Recently a two-detector algorithm was developed, which appears to be satisfactory if the sonde is calibrated in the appropriate-diameter borehole. In this report we describe the calibration procedures and the algorithms for both methods.

22107 (UCRL-JC–119291) **Low-energy response of superconducting tunnel junction x-ray spectrometers.** Labov, S.E. (Lawrence Livermore National Lab., CA (United States)); Hiller, L.H.; Measrs, C.A.; Frank, M.; Netel, H.; Azgui, F.; Barfknecht, A.T. Lawrence Livermore National Lab., CA (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract NAS5-38013; Grant NAGW-3907. (CONF-941013–37: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95011733. Source: OSTI; NTIS; GPO Dep.

Thin film structures incorporating metallic superconducting layers and tunnel junctions can be configured as low-energy X-ray spectrometers. We present results obtained when low-energy X-rays are absorbed in niobium films coupled to aluminum layers that serve as quasiparticle traps in an Nb/Al/Al_2O_3/Al/Nb tunnel junction X-ray detector. The linearity of the pulse height as a function of energy is discussed along with the energy dependence of the observed resolution and its relation to the broadening mechanisms. A resolution of 14 eV at 1 keV has been measured with our detector cooled to 0.3 K.

22108 (UCRL-JC–119293) **Non-equilibrium dynamics in superconducting tunnel junction detectors.** Hiller, L.J. (Argonne National Lab., IL (United States)); Labov, S.E.; Mears, C.A.; Frank, M.; Bello, A.F.; Barfknecht, A.T. Lawrence Livermore National Lab., CA (United States). 9 Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract NAS5-38013; Grant NAGW-3907. (CONF-940723–41: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE95011734. Source: OSTI; NTIS; GPO Dep.

Superconducting tunnel junctions have the potential to serve as high-resolution, high-efficiency x-ray detectors for astrophysical and industrial applications. When irradiated by X rays, each X ray excites over 10^6 charge carriers which cause the detector to generate a pulse of current. We present an analysis of pulse shapes from detectors we have constructed and operated. We fit the decay of the current pulse to a simple model that considers two classes of carrier loss. One model considers only the normal recombination of the charge carriers with themselves, the other included additional losses due to recombination sites in the within the detector medium. We found that both mechanisms most be taken into account. We also found a small variation in pulse shape depending on which layer of the tunnel junction absorbed the X ray. We expect that this analysis will be a useful tool in comparing different detector designs and operating conditions.

22109 (VAEC-B–025) **On the second kinetic order thermoluminescent glow curves.** Dang Thanh Luong (Institute of Nuclear Science and Technology, Hanoi (Viet Nam)); Nguyen Hao Quang; Hoang Minh Giang. Viet Nam National Atomic Energy Commission, Ha Noi (Viet Nam). 1995. 10p. R-project 324. Order Number DE95632449. Source: OSTI; NTIS (US Sales Only); INIS.

The kinetic parameters of thermoluminescent material such as CaF_2-N and $CaSO_4$-Dy with the different grain sizes are investigated in detail using the least square method of fitting. It was found that the activation energy E (or trap depth) and peak temperature T_max are changed with the elapsed time between the irradiation and read-out for the low temperature glow curve peaks.

The similar TL glow curve shapes are obtained for the different $CaSO_4$-Dy grain size. (author). 7 refs., 5 figs., 2 tabs.

22110 (VAEC-E–026) **Silver dichromate - a suitable dosimeter for radiation processing.** Hoang Hoa Mai (Institute of Nuclear Science and Technology, Hanoi (Viet Nam)); Nguyen Dinh Duong. Viet Nam National Atomic Energy Commission, Ha Noi (Viet Nam). 1995. 13p. Order Number DE95632450. Source: OSTI; NTIS (US Sales Only); INIS.

An aqueous dosimeter system based on solution of silver dichromate in perchloric acid and spectrophotometry analysis was investigated. The optical absorption characteristics of solutions have been studied. The molar extinction coefficients and radiation-yield of the dosimeter solutions were determined. The mechanism of radiation-induced reactions in the solutions is also considered. A formula for calculating the dose based on absorbance measurements is presented. The G-value of dichromate reduction caused by gamma radiation was determined. The value found, 0.397 is close to the values of the other authors. Two solutions with different concentrations of dichromate have been chosen to match two applicable dose ranges. The solution containing 0.5 mM $Ag_2Cr_2O_7$ in 0.1 M $HClO_4$ is applied to dose range of 1 -12 kGy and the solution with 0.5 mM $Ag_2Cr_2O_7$ and 2.00 mM $K_2Cr_2O_7$ in 0.1 M $HClO_4$ is applied to dose range of 3 to 50 kGy. It was found that the relationship between net absorbance ΔA and radiation dose, D is essentially linear over expected dose ranges. The calibration curves have been drawn up by using least square method. In routine use for gamma radiation the dosimeter show good accuracy, reproducibility and stability of the response. (author). 10 refs., 4 figs., 3 tabs.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 21855

4405 Thermal Instrumentation

Refer also to citation(s) 21084

4406 Optical Instrumentation

Refer also to citation(s) 21557, 21628, 21631, 21680, 21722, 21780, 21843

22111 (CONF-941144–156) **Fabrication of optical channel waveguides in the GaAs/AlGaAs system by MeV ion beam bombardment.** Taylor, T. (Alabama A and M Univ., Normal, AL (United States). Dept. of Physics); Ila, D.; Zimmerman, R.L.; Ashley, P.R.; Poker, D.B. Oak Ridge National Lab., TN (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. G rii880291. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95008973. Source: OSTI; NTIS; GPO Dep.

We have fabricated optical channel waveguides in planar GaAs/AlGaAs waveguides using 10 MeV oxygen ions at a fluence of 3×10^{13} and 3×10^{14} ions/cm^2. Although disordering o GaAs/AlGaAs quantum well structures has previously been reported, to the best of the authors' knowledge the fabrication of channel waveguides using high energy oxygen bombardment has not been demonstrated in this material system. This technique may provide a totally new concept of localized material modifications in GaAs/AlGaAs waveguides by creating compositional disordered regions that act as optical confinement channels. The masking technique used to provide selective disordering of the planar waveguide structures will be presented. Optical measurements were performed on the channel waveguides at a wavelength of 1.3 μm.

22112 (LBL–36845) **Quantum mechanical capacitance in a scanning tunneling microscope.** Botkin, D.; Weiss, S.; Ogletree, D.F.; Salmeron, M.; Chemla, D.S. Lawrence Berkeley Lab., CA (United States). Feb 1995. 7p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. # N000-14.93.105.36. (CONF-9503146–1: Ultrafast electronics and optoelectronics symposium, Dana Point, CA (United States), Mar 1995). Order Number DE95011272. Source: OSTI; NTIS; GPO Dep.

The nature of the ultrafast response of the tunnel junction in a scanning tunneling microscope is discussed.

22113 (SAND–94-2002C) **Laser beaming demonstrations at the Starfire Optical Range.** Lipinski, R.J. (Sandia National Labs., Albuquerque, NM (United States)); Meister, D.C.; Tucker, S.; Leatherman, P.; Fugate, R.Q.; Maes, C.; Lange, W.J.; Cowan, W.; Cleis, R.A.; Spinhirne, J.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950226–43: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95007747. Source: OSTI; NTIS; GPO Dep.

The ability to acquire, track, and accurately direct a laser beam to a satellite is crucial for power-beaming and laser-communications. To assess the state of the art in this area, a team consisting of Air Force Phillips Laboratory, Sandia National Laboratories, and COMSAT Corporation personnel performed some laser beaming demonstrations to various satellites. A ruby laser and a frequency-doubled YAG laser were used with the Phillips Lab Starfire Optical Range (SOR) beam director for this activity. The ruby laser projected 20 J in 6 ms out the telescope with a beam divergence that increased from 1.4 to 4 times the diffraction limit during that time. The doubled YAG projected 0.09 J in 10 ns at 20 Hz. The SOR team demonstrated the ability to move rapidly to a satellite, center it in the telescope, then lock onto it with the tracker, and establish illumination. Several low-earth-orbit satellites with corner-cube retro-reflectors were illuminated at ranges from 1000 to 6000 km with a beam divergence estimated to be about 20 μradians. The return signal from the ruby laser was collected in a 15-cm telescope, detected by a photomultiplier tube, and recorded at 400 kHz. Rapid variations in intensity (as short at 15 μs) were noted, which may be due to speckles caused by phase interference from light reflected from different retro-reflectors on the satellite. The return light from the YAG was collected by a 35-cm telescope and detected by an intensified CCD camera. The satellite brightened by about a factor of 30 in the sunlight when the laser was turned on, and dimmed back to normal when the 50-μradian point-ahead was turned off. The satellite was illuminated at 1 Hz as it entered the earth's shadow and followed for about 10 seconds in the shadow. In another demonstration, four neighboring GEO satellites were located and centered in succession with a 3.5-m telescope at a rate of about 16 seconds per satellite.

22114 (UCRL-JC–116858) **Feasibility of fullerene thin films for high-speed all-optical switching.** Lee, H.W.H.; Hughes, R.S. Jr.; Davis, J.E.; MConaghy, C.F.; Hamza, A.V.; Balooch, M. Lawrence Livermore National Lab., CA (United States). May 1994. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940582–8: CLEO '94: conference on lasers and electro-optics, Anaheim, CA (United States), 8-13 May 1994). Order Number DE95011735. Source: OSTI; NTIS; GPO Dep.

We measured the optical nonlinearity of fullerene thin films (C_{60},C_{70}) from 710–850 nm and determined the figure of merit for all-optical switching. We also demonstrated, to our knowledge, the first fullerene-based all-optical switch.

22115 (UCRL-JC–119064) **Beryllium based multilayers for normal incidence extreme ultraviolet reflectance.** Skulina, K. (Lawrence Livermore National Lab., CA (United States)); Alford, C.; Bionta, R.; Makowiecki, D.; Gullikson, E.; Soufli, R.; Kortright, J.; Underwood, J. Lawrence Livermore National Lab., CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409177–7: Optical Society of America conference on extreme ultraviolet lithography, Monterey, CA (United States), 19-21 Sep 1994). Order Number DE95011760. Source: OSTI; NTIS; GPO Dep.

We report the experimental results of beryllium based multilayer mirrors for use in the 11.4 nm region. Mirrors using molybdenum

as the high-Z material have demonstrated 68.7% peak reflectance at 11.3 nm.

22116 (UCRL-JC–120534) **Underwater laser imaging system (UWLIS).** DeLong, M.L. (Lawrence Livermore National Lab., CA (United States)); Kulp, T.J. Lawrence Livermore National Lab., CA (United States). 10 Mar 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504154–2: Symposium on autonomous vehicles in mine countermeasures, Monterey, CA (United States), 3-7 Apr 1995). Order Number DE95011759. Source: OSTI; NTIS; GPO Dep.

Practical limitations of underwater imaging systems are reached when the noise in the back scattered radiation generated in the water between the imaging system and the target obscures the spatial contrast and the resolution necessary for target discovery and identification. The advent of high power lasers operating in the oceanic transmission window of the visible spectrum (blue-green portion) has led to improved experimental illumination systems for underwater imaging The properties of laser bearm in range-gated and synchronously scanned devices take advantage of the unique temporal and spatial coherence effect of common volume back scatter to reduce or eliminate noise, increase signal to noise levels. Synchronously scanned systems rely on the highly collimated nature of the laser beam for spatial rejection of common volume back scatter. A synchronous, raster-scanning underwater laser imaging system (UWLIS) has been developed at Lawrence liver-more National Laboratory. The present UWLIS system differs from earlier synchronous scanners in its ability to scan in two dimensions at conventional video frame rate (30 Hz). The imaging performance of the present UWLIS was measured at distances of up to 6.3 AL (at a physical distance of 15.2 meters) during an in-water tank test and 4.5 to 5.0 AL (at a physical distance of 30 meters) during open water oceanic testing. The test results indicate that the UWLIS system is already capable of extending the underwater imaging range beyond that of conventional floodlight illuminated SIT cameras. The real or near real time frame rates of the UWLIS make possible operations in a mode in which the platform speed is randomly varied. This is typical of the operational environment in which the platform is often maneuvered above and around rugged seafloor terrain's and obstacles.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 20606, 20607, 20608, 20967, 22106

22117 (UCRL-JC–119287) **A low diffraction beam technique for scanning in the shallow ocean.** Lewis, D.K. Lawrence Livermore National Lab., CA (United States). 1 Dec 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9406241–2: Inversion methods in ocean and seismic acoustics conference, La Spezia (Italy), 27 Jun 1994). Order Number DE95011742. Source: OSTI; NTIS; GPO Dep.

The Localized Wave pulse project has created the concept of highly localized, pulsed wave energy. We have confirmed, and developed the technique in a series of experimental and numerical tests. This technique generates radiation, mechanical or electromagnetic, from an array. LW generation sends a broad frequency bandwidth pulse of energy along the array axis. The pulse has no sidelobes and maintains the frequency bandwidth and pulse amplitude better than any other method proposed to date. Confirmation of the theory by acoustic experiments show that the effect is real, and that the advantages of the technique can be realized in a laboratory environment. Numerical studies have shown that this effect is extendible to the microwave (vector field) and elastodynamic (tensor field) regimes as well as the stratified ocean environment. The main features of the LW beam are (1) the pulses are broad bandwidth and maintain that bandwidth over their entire working range; (2) the beam generates no side lobes; (3) the LW effect is accomplished in the linear regime, so that small errors in beam generation result in a less effective beam not the loss of the effect; and (4) the beam can be generated using present technology in the acoustic realm. The LW beam has a wide range of applications. As an active source, it offers a unique method of variable beam forming from spatially wide to the narrowest possible beam. Its uses include oceanographic sound velocity profile estimation and attenuation measurements. Since the pulse characteristics are changeable through the source signal parameters, it also offers the possibility of adaptive beam forming in real time. Passively, the LW array can use a wide spatial width listening pattern until something of interest occurs. Instantaneously, the listening pattern could be changed to a very narrow, steerable beam with a broad bandwidth. These uses also apply in the electromagnetic realm.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 20626, 20881, 21223, 21236, 21774, 21963, 22007, 22262, 22788

22118 (LBL–34503) **Scanning tunneling microscopy tip-dependent image contrast of S/Pt(111) by controlled atom transfer.** McIntyre, B.J. (Lawrence Berkeley Lab., CA (United States)); Dunphy, J.C.; Salmeron, M.; Somorjai, G.A.; Sautet, P. Lawrence Berkeley Lab., CA (United States). Oct 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9308266–1: International conference on scanning tunneling microscopy, Beijing (China), 9-14 Aug 1993). Order Number DE95011280. Source: OSTI; NTIS; GPO Dep.

Sudden changes in the detailed appearance and corrugation of atomic-resolution scanning tunneling microscopy (STM) images are commonly observed. In particular, these effects for the Pt(111)($\sqrt{3} \times \sqrt{3}$)R30°-sulfur structure have been studied. Corrugation changes have been investigated by the controlled transfer of atoms between tip and sample. Theoretical images simulations using electron scattering quantum chemical methods show that the image contrast is strongly dependent on the chemical identity of the STM tip atom. Observed changes in the sulfur images can be explained by changes from platinum-terminated to sulfur-terminated STM tips.

22119 (PNL–10421) **Meier associates and Pacific Northwest Laboratory staff exchange: Transfer of corrosion monitoring expertise to assess and develop in-line inspection tools for corrosion control.** Olson, N.J. (Pacific Northwest Lab., Richland, WA (United States)); Meier, T.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95011671. Source: OSTI; NTIS; GPO Dep.

Staff exchanges, such as the one described in this report, are intended to facilitate communication and collaboration among scientists and engineers at DOE laboratories, in US industry, and academia. During the past 5 years, PNL has developed prototype instrumentation to automate the data collection required for electrochemical determination of corrosion rates and behavior of materials in various electrically conductive environments. The last version is labeled the Sentry 100 prototype corrosion data scanner. Applications include these in the pulp and paper industry and at hazardous waste sites.

22120 (SAND–95-0854C) **Self-consistent temperature compensation for resonant sensors with application to quartz bulk acoustic wave chemical sensors.** Smith, J.H. (Sandia National Labs., Albuquerque, NM (United States)); Senturia, S.D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950650–3: 8. international conference on solid-state sensors and actuators and 9th biannual international conference and annual European conference on solid-state sensors, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95011882. Source: OSTI; NTIS; GPO Dep.

Since resonant sensors have a temperature sensitivity which is often greater than their sensitivity to the phenomena they are being used to detect, it is imperative to include either temperature control or temperature compensation in any resonant sensor system. The authors have developed a temperature-compensation scheme for resonant sensors which is amenable to integration into a resonator-driver integrated circuit. An integrated circuit incorporating this scheme has been designed, built, and tested.

22121 (SAND–95-1144C) **Sensing liquid properties with shear-mode resonator sensors.** Martin, S.J. (Sandia National Labs., Albuquerque, NM (United States)); Cernosek, R.W.; Spates, J.J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506192–2: Transducers '95, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95013554. Source: OSTI; NTIS; GPO Dep.

Liquid properties are measured from the changes they induce in the resonant frequency and damping of thicknessshear mode quartz resonators. A smooth-surfaced resonator viscously entrains the contacting fluid and responds to the density-viscosity product. Separation of density and viscosity is accomplished using two devices: one with a smooth surface and one with a corrugated surface that traps fluid. By observing the difference in stored and dissipated energies in the contacting fluid, its non-Newtonian characteristics can also be determined.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 21622, 22330

22122 (SAND–95-0453C) **Fusion of LADAR with SAR for precision strike.** Cress, D.H.; Muguira, M.R. Sandia National Labs., Albuquerque, NM (United States). Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9503155–1: 8. national symposium on sensor fusion, Dallas, TX (United States), 15-17 Mar 1995). Order Number DE95012225. Source: OSTI; NTIS; GPO Dep.

This paper presents a concept for fusing 3-dimensional image reconnaissance data with LADAR imagery for aim point refinement. The approach is applicable to fixed or quasi-fixed targets. Quasi-fixed targets are targets that are not expected to be moved between the time of reconnaissance and the time of target engagement. The 3-dimensional image data is presumed to come from standoff reconnaissance assets tens to hundreds of kilometers from the target area or acquisitions prior to hostilities. Examples are synthetic aperture radar (SAR) or stereoprocessed satellite imagery. SAR can be used to generate a 3-dimensional map of the surface through processing of data acquired with conventional SAR acquired using two closely spaced, parallel reconnaissance paths, either airborne or satellite based. Alternatively, a specialized airborne SAR having two receiving antennas may be used for data acquisition. The data sets used in this analysis are: (1) LADAR data acquired using a Hughes-Danbury system flown over a portion of Kirtland AFB during the period September 15–16, 1993; (2) two pass interferometric SAR data flown over a terrain-dominated area of Kirtland AFB; (3) 3-dimensional mapping of an urban-dominated area of the Sandia National Laboratories and adjacent cultural area extracted from aerial photography by Vexcel Corporation; (4) LADAR data acquired at Eglin AFB under Wright Laboratory's Advanced Technology Ladar System (ATLAS) program using a 60 μJ, 75 KHz Co_2 laser; and (5) two pass interferometric SAR data generated by Sandia's STRIP DCS (Data Collection System) radar corresponding to the ATLAS LADAR data. The cultural data set was used in the urban area rather than SAR because high quality interferometric SAR data were not available for the urban-type area.

22123 (UCRL-ID–119197) **Loch Linnhe '94: Test operations description and on-site analysis, US activities.** Mantrom, D.D. Lawrence Livermore National Lab., CA (United States). Nov 1994. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011700. Source: OSTI; NTIS; GPO Dep.

A field experiment named Loch Linnhe '94 (LL94) is described. This experiment was conducted in upper Loch Linnhe, Scotland, in September 1994, as an exercise involving UK and US investigators, under the Joint UK/US Radar Ocean Imaging Program. This experiment involved a dual-frequency, dual-polarization hillside real aperture radar operated by the UK, Lawrence Livermore National Laboratory's (LLNL) current meter array (CMA), in-water hydrodynamic sensors, and meteorological measurements. The primary measurements involved imaging ship-generated and ambient internal waves by the radar and the CMA. This report documents test operations from a US perspective and presents on-site analysis results derived by US investigators. The rationale underlying complementary radar and C@ measurements is described. Descriptions of the test site, platforms, and major US instrument systems are given. A summary of test operations and examples of radar, CMA, water column profile, and meteorological data are provided. A description of the rather extensive analysis of these data performed at the LL94 test site is presented. The products of this analysis are presented and some implications for further analysis and future experiments are discussed. All experimental objectives were either fully or partially met. Powerful on-site analysis capabilities generated many useful products and helped improve subsequent data collection. Significant further data analysis is planned.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 21553, 21554, 21693, 22259, 22352

22124 (LA–12939-MS) **Formulation of non-lacquer (latex) PBX-9502.** Sadler, C.P.; Freer, J.E. Los Alamos National Lab., NM (United States). Jun 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012141. Source: OSTI; NTIS; GPO Dep.

Waste minimization necessitates evaluation of current waste streams with regard to new processing methods and technology. PBX-9502 (95% TATB/5% Kel-F 800) uses an ethyl acetate solvent to dissolve the Kel-F 800 resin, creating a lacquer for coating TATB. This report describes a new latex polymer application method for PBX-9502, which eliminates the H_2O-to-ethyl acetate rinse-out and the resultant solvent-contaminated water waste stream and distillation air emissions.

22125 (LA-UR–95-610) **Swept frequency acoustic interferometry technique for chemical weapons verification and monitoring.** Sinha, D.N.; Anthony, B.W.; Lizon, D.C. Los Alamos National Lab., NM (United States). [1995]. 8p. Sponsored by Defense Nuclear Agency, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950163–4: 3. international on-site analysis conference, Houston, TX (United States), 22-25 Jan 1995). Order Number DE95007854. Source: OSTI; NTIS; GPO Dep.

Nondestructive evaluation (NDE) techniques are important for rapid on-site verification and monitoring of chemical munitions, such as artillery shells and bulk containers. Present NDE techniques provide only limited characterizations of such munitions. This paper describes the development of a novel noninvasive technique, swept-frequency acoustic interferometry (SFAI), that significantly enhances the capability of munitions characterizations. The SFAI technique allows very accurate and simultaneous determination of sound velocity and attenuation of chemical agents over a large frequency range inside artillery shells, in addition to determining agent density. The frequency-dependent sound velocity and attenuation can, in principle, provide molecular relaxation properties of the chemical agent. The same instrument also enables a direct fill-level measurement in bulk containers. Industrial and other applications of this general-purpose technique are also discussed.

22126 (LA-UR–95-1164) **Final report on the oxidation of energetic materials in supercritical water. Final Air Force report.** Buelow, S.J. (and others); Allen, D.; Anderson, G.K. Los Alamos National Lab., NM (United States). 3 Apr 1995. 222p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010888. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to determine the suitability of oxidation in supercritical fluids (SCO), particularly water (SCWO), for disposal of propellants, explosives, and pyrotechnics (PEPs). The SCO studies of PEPs addressed the following issues: The efficiency of destruction of the substrate. The products of destruction contained in the effluents. Whether the process can be conducted safely on a large scale. Whether energy recovery from the process is economically practicable. The information essential for process

development and equipment design was also investigated, including issues such as practical throughput of explosives through a SCWO reactor, reactor materials and corrosion, and models for process design and optimization.

22127 (SAND–94-0774) **Prompt laser ignition and transition to detonation in a secondary explosive.** Setchell, R.E.; Trott, W.M. Sandia National Labs., Albuquerque, NM (United States). May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012115. Source: OSTI; NTIS; GPO Dep.

A two-stage approach to achieving detonation in a secondary explosive was developed in previous studies in which ignition resulted from low-energy hot wires or from laser diodes. In the current study, this approach was examined in some detail for the case of ignition by a pulsed, solid-state (rod) laser. An initial series of experiments used Nd/glass, Nd/YAG, and Ti/sapphire lasers to investigate the ignition of graphite-doped HMX in highly confined optical fixtures that incorporated a fast piezoelectric pressure transducer. Experimental parameters included the laser power history and the explosive column length. The results of these experiments guided a second series of experiments in which the ignition column explosive was terminated by a thin rupture disc in contact with a transition column of low-density HMX or some other material. The transition column was terminated with a piezoelectric time-of-arrival detector for determining overall function times. Parameters investigated included different laser sources, rupture disc thicknesses, and the transition column explosive characteristics. Overall function times less than 50 microseconds were obtained, and trends established by the various parameter studies indicate that further reductions in function time can be achieved.

22128 (SAND–94-2787C) **Development and production of two explosive components using SCB technology.** Tarbell, W.W. (Sandia National Labs., Albuquerque, NM (United States)); Sanchez, D.H.; Oestreich, M.L.; Prentice, J.W. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950720–3: AIAA/SAE/ASME joint propulsion conference and exhibit, San Diego, CA (United States), 10-12 Jul 1995). Order Number DE95011875. Source: OSTI; NTIS; GPO Dep.

For many years, explosive components have used hotwires to convert an electrical stimulus into the thermal energy required to initiate the device. A Semi-Conductor Bridge (SCB) performs the same function, but with the advantage of requiring approximately 1/10 the input energy of a comparable hotwire, while retaining excellent no-fire characteristics. The SCB also demonstrates faster function times due to its inherently-lower thermal mass. This paper discusses the development and production of two SCB-based devices, the MC4491 Initiator and the MC4492 Actuator. The initiator is designed to shock initiate a linear shaped charge by accelerating a thin metal plate across a small gap. The actuator functions several different components, serving as either an actuator by producing a rapidly expanding gas to activate piston mechanisms or as an ignitor by providing hot particles for initiating pyrotechnic mixtures. Details are provided on the construction of both devices, methods of assembly, and performance characteristics (function time, flyer velocity, pressure in a closed bomb, heat content, and no-fire and all-fire levels).

22129 (SAND–94-2862C) **Performance characterization of the NASA standard detonator.** Tarbell, W.W. (Sandia National Labs., Albuquerque, NM (United States)); Burke, T.L.; Solomon, S.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950720–4: AIAA/SAE/ASME joint propulsion conference and exhibit, San Diego, CA (United States), 10-12 Jul 1995). Order Number DE95011876. Source: OSTI; NTIS; GPO Dep.

The NASA Standard Detonator (NSD) is employed in support of a number of current applications, including the Space Shuttle. This effort was directed towards providing test results to characterize the output of this device for its use in a safe and arm device. As part of the investigation, flash X-ray was used to provide stop-motion photographs of the flying metal plate that is created by initiation of the detonator. This provided researchers with a better understanding of the shape and character of the high-velocity disk as it propagated across the gap between the detonator and next assembly. The second portion of the study used a velocity interferometer to evaluate the acceleration and velocity histories of the flying plate, providing a quantified assessment of the detonator's ability to initiate the explosive in the next explosive.

22130 (SAND–95-8587C) **Reapplication of energetic materials at fuels.** Baxter, L. (Sandia National Labs., Livermore, CA (United States)); Sinquefield, S.; Huey, S.; Lipkin, J.; Shah, D.; Ross, J.; Sclippa, G.; Davis, K. Sandia National Labs., Livermore, CA (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9504163–2: Combustion Institute and American Flame Research onference, San Antonio, TX (United States), 23-26 Apr 1995). Order Number DE95011409. Source: OSTI; NTIS; GPO Dep.

This investigation addresses the combustion-related aspects of the reapplication of energetic materials as fuels in boilers as an economically viable and environmentally acceptable use of excess energetic materials. The economics of this approach indicate that the revenues from power generation and chemical recovery approximately equal the costs of boiler modification and changes in operation. The primary tradeoff is the cost of desensitizing the fuels against the cost of open burn/open detonation (OB/OD) or other disposal techniques. Two principal combustion-related obstacles to the use of energetic-material-derived fuels are NO_x generation and the behavior of metals. NO_x measurements obtained in this investigation indicate that the nitrated components (nitrocellulose, nitroglycerin, etc.) of energetic materials decompose with NO_x as the primary product. This can lead to high uncontrolled NO_x levels (as high as 2600 ppm on a 3% O_2 basis for a 5% blend of energetic material in the fuel). NO_x levels are sensitive to local stoichiometry and temperature. The observed trends resemble those common during the combustion of other nitrogen containing fuels. Implications for NO_x control strategies are discussed. The behavior of inorganic components in energetic materials tested in this investigation could lead to boiler maintenance problems such as deposition, grate failure, and bed agglomeration. The root cause of the problem is the potentially extreme temperature generated during metal combustion. Implications for furnace selection and operation are discussed.

22131 (UCRL-ID–118353) **Reynolds Industries Systems Inc. SQ-80 ignitor performance characterization.** Cutting, J.L.; Lee, R.S. Lawrence Livermore National Lab., CA (United States). Jul 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014456. Source: OSTI; NTIS; GPO Dep.

RISI SQ-80 ignitor is a thermite filled exploding bridgewire ignitor. Eleven shots were fired. Film development time was the major time problem. Other problems also existed. These EBW ignitors should enhance safety in igniting rocket propellant. 11 figs.

22132 (UCRL-ID–119672) **Characterization of TNAZ.** Simpson, R.L.; Garza, R.G.; Foltz, M.F.; Ornellas, D.L.; Utriew, P.A. Lawrence Livermore National Lab., CA (United States). 14 Dec 1994. 12p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011524. Source: OSTI; NTIS; GPO Dep.

The explosive TNAZ has recently become available in pilot-plant quantities. We have found its small-scale safety properties similar to those of other nitramines. Detonation calorimetry showed TNAZ to have 96% the energy of HMX and 150% of TNT. The shock sensitivity of neat TNAZ is greater than LX-14. A retonation wave was observed when the material was shocked at 2.0 GPa. The initiation behavior of neat TNAZ cannot be classified as either homogeneous or heterogeneous. Six plastic bonded TNAZ-based explosives have been developed for the Army.

22133 (UCRL-ID–120479) **CIST....CORRTEX interferometer simulation test.** Heinle, R.A. Lawrence Livermore National Lab., CA (United States). Dec 1994. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011427. Source: OSTI; NTIS; GPO Dep.

Testing was performed in order to validate and cross calibrate an RF interferometer and the crush threshold of cable. Nitromethane was exploded (inside of PVC pipe). The explosion was used to crush the interferometer sensor cables which had been placed inside and outside the pipe. Results are described.

22134 (UCRL-ID–120838) **Factors affecting the erosion of jets penetrating high explosive.** Haselman, L.C.; Winer, K.A. Lawrence Livermore National Lab., CA (United States). 1 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013296. Source: OSTI; NTIS; GPO Dep.

It has been observed in various experiments with shaped charge jets penetrating high explosives that the erosion of the jet can be considerably greater than that expected from analytical theory or from two dimensional hydrodynamic computer simulations. In a previous study, we found that the initial penetration of the jet agreed with theory, and that the erosion of the jet happened subsequent to the initial penetration. This additional erosion can be the dominant factor in the total length of jet that is eroded. We also found that in one experiment the jet did not show any excess erosion and that the penetration could be predicted from theory. We also found a rough correlation of the amount of excess erosion with the diameter of the jet, with larger jet diameters giving less erosion. A problem with previous experiments was that a wide variety of shaped charges, target shapes, and target thicknesses were used. This made it difficult to isolate the effect of a particular parameter. For the current study we chose to isolate the effects of scale and target thickness. For this purpose we used well characterized jets and carefully chosen targets. We also did computer calculations to help elucidate the underlying mechanisms of the excess erosion.

22135 (UCRL-JC–117805) **Temperature-dependent shock initiation of LX-17 explosive.** Lee, R.S.; Chau, H.H.; Druce, R.L.; Moua, K. Lawrence Livermore National Lab., CA (United States). Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506142–2: 4. international symposium on behavior of dense media under high dynamic pressure, Tours (France), 5-9 Jun 1995). Order Number DE95012475. Source: OSTI; NTIS; GPO Dep.

LX-17 samples, heated to temperatures up to 250 C, were impacted by 3 to 10-mm-wide, 50.8-mm-long strips of 0.13-mm-thick Kapton polyimide film at velocities up to 7.7 km/s. The Kapton strips were laminated onto a thin aluminum bridge foil and were launched to the desired velocity by discharging a capacitor bank through the foil, causing the foil to explode. The LX-17 samples were confined in a steel holder and heated in an oven to the desired temperature. After the capacitor bank was charged, the LX-17 sample in its steel holder was remotely drawn out of the oven on rails and positioned over the bridge-foil/Kapton-strip laminate. When the sample was in position, the bank was discharged, launching the Kapton strip against the LX-17 surface. The shock initiation threshold was measured for 3, 7, and 10-mm-wide strips at room temperature, 200 C and 250 C. The authors found a significant reduction in the velocity threshold and in the critical area for initiation when the samples were heated. The authors compare the results with the earlier data of Bloom, who measured the initiation threshold of LX-17 over the density range 1.8–1.91 g/cm^3 at room temperature and −54 C. LX-17 has a large coefficient of thermal expansion, as reported by Urtiew, et al., which reduces its density significantly t elevated temperatures. They find that the change of shock initiation threshold with temperature is consistent with the change in sample density, using the relation between threshold and density reported by Bloom.

22136 (UCRL-JC–119069) **Buried mine detection using ground-penetrating impulse radar.** Sargis, P.D. Lawrence Livermore National Lab., CA (United States). Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504154–1: Symposium on autonomous vehicles in mine countermeasures, Monterey, CA (United States), 3-7 Apr 1995). Order Number DE95011443. Source: OSTI; NTIS; GPO Dep.

LLNL is developing a side-looking, ground-penetrating impulse radar system that can eventually be mounted on a robotic vehicle or an airborne platform to locate buried land mines. The system is described and results from field experiments are presented.

22137 (UCRL-JC–119203) **Particulation in jets from free-form hemispherical shaped charges with copper liners.** Simonson, S.C. III; Haselman, L.C. Jr.; Breithaupt, R.D. Lawrence Livermore National Lab., CA (United States). May 1995. 8p. Sponsored by Department of Defense, Washington, DC (United States);USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9505229–1: 45. annual bomb and warhead technical symposium, Huntsville, AL (United States), 16-17 May 1995). Order Number DE95014455. Source: OSTI; NTIS; GPO Dep.

Particulation in free-form hemispherical shaped charge jets is considerably different from that in conical shaped charge jets. From the analysis of the particulation data for 23 experiments covering ten free-form hemi designs with copper liners, it is concluded that jets with higher convergence pressures have delayed particulation, sometimes by as much as a factor of two. Breakup is also found to be design dependent, with free-form hemis have delayed breakup compared with cones. Also, in going from the earlier, boat-tail high explosive (HE) designs to later, more efficient hemispherical HE designs, it is found that particulation is delayed in the tail of the jet. These effects indicate the potential for deeper armor penetration based on control of particulation.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 21551, 21553, 21554, 22150, 22471

22138 (UCRL-ID–120477) **KAWICH-A: Containment data report.** Heinle, R.; Stubbs, T. Lawrence Livermore National Lab., CA (United States). Aug 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011426. Source: OSTI; NTIS; GPO Dep.

This report briefly describes the KAWICH-A event, containment, and measuring instruments utilized. Diagrams are presented on pressure and radiation histories, containment instrumentation plan, and sanded gypsum emplacement.

22139 (UCRL-ID–120478) **NORMANNA containment data report.** Hudson, B.; Stubbs, T.; Heinle, R. Lawrence Livermore National Lab., CA (United States). Mar 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011512. Source: OSTI; NTIS; GPO Dep.

The second in a series of three similar experiments, NORMANNA was located in hole U10cb in area 10 of the Nevada Test Site (NTS). The first experiment of this series (JARLSBERG) was conducted about one year earlier. The diameter of the emplacement hole was 2.18 m and the depth-of-burial of 203 m placed the working point in alluvium about 100 m above the Paleozoic contact and nearly 300 m above the static water level. NORMANNA was detonated on July 12, 1984 at 07:00 PDT. All phenomena appeared normal with a chimney collapse to the ground surface about 7 minutes later. The mean radius of the resulting crater was 54.1 m and its maximum depth was 8.8 m. No radiation arrivals were detected above ground and containment was satisfactory.

22140 (UCRL-ID–120480) **PANAMINT: Containment data report.** Hudson, B.; Stubbs, T.; Heinle, R. Lawrence Livermore National Lab., CA (United States). Mar 1995. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011422. Source: OSTI; NTIS; GPO Dep.

The PANAMINT event was detonated in hole U2gb of the Nevada Test Site at 13:59 PDT on May 21, 1986. This paper contains a discussion of that event, with special attention given to the instrumentation designed to monitor stemming emplacement and performance. Data from those instruments are presented.

22141 (UCRL-ID–120567) **LLNL review of the 1994 accelerator production of tritium (APT) concept.** Alesso, H.P. (and others); Barnard, J.J.; Booth, R. Lawrence Livermore National Lab., CA (United States). 8 Mar 1995. 38p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012260. Source: OSTI; NTIS; GPO Dep.

LLNL was asked in September 1994 to review the accelerator production of tritium (APT) concept as it had evolved up to the fall of 1994. The purpose was not to compare it to other sources of tritium, but to identify possible technical flaws in the concept and to assess feasibility. The APT concept reviewed was based on a 1.0 GeV normal conducting proton linac operating CW at currents up to 200 mA with a target of tungsten and blanket of ^{3}He and lead. The LLNL review group concurs with the conclusions of four previous reviews (1989 to 1994) that this concept can meet the tritium requirements of a reduced stockpile of approximately 3,500 ± 1,500 warheads. The authors believe that the predicted tritium production rate is based on sound nuclear and transport models and that the schedules for technology demonstrations, design, and construction are realistic. They conclude that the technical risk of the concept is low and can be managed within the risk reduction program. The risk reduction program should focus on risk to the schedule and on cost reduction.

22142 (UCRL-ID–120650) **ORKNEY: Containment data report.** Heinle, R.; Hudson, B.; Stubbs, T. Lawrence Livermore National Lab., CA (United States). Mar 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011423. Source: OSTI; NTIS; GPO Dep.

The ORKNEY event was detonated in hole U10be of the Nevada Test Site at 6:50 PST on May 2, 1984. This paper contains a discussion of that event, with special attention given to the instrumentation for monitoring stemming emplacement and performance of the event. Data from these instruments are presented.

22143 (UCRL-ID–120651) **BRIE containment data report.** Hudson, B.; Stubbs, T.; Heinle, R. Lawrence Livermore National Lab., CA (United States). Mar 1995. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011526. Source: OSTI; NTIS; GPO Dep.

The third in a series of experiments in close proximity, BRIE was located in hole U10cc in area 10 of the Nevada Test Site (NTS). The first experiment (JARLSBERG) was conducted about four years earlier while the second experiment (NORMANNA) was detonated about three years earlier. The diameter of the emplacement hole was 2.18 m and the depth-of-burial of 203 m placed the working point in alluvium about 100 m above the Paleozoic contact and nearly 300 m above the static water level. BRIE was detonated on June 18, 1987, at 08:20 PDT. All phenomena appeared normal with a chimney collapse broaching the ground surface about 17 minutes later. The mean radius of the resulting crater was 54.1 m and its maximum depth was 10.3 m. No radiation arrivals were detected above ground and containment was satisfactory.

22144 (UCRL-JC–118788) **Consistent finite-volume discretization of hydrodynamic conservation laws for unstructured grids.** Burton, D.E. Lawrence Livermore National Lab., CA (United States). 17 Oct 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410254–6: Nuclear explosives code developers conference (NECDC), Las Vegas, NV (United States), 27 Oct 1994). Order Number DE95011730. Source: OSTI; NTIS; GPO Dep.

We consider the conservation properties of a staggered-grid Lagrange formulation of the hydrodynamics equations (SGH). Hydrodynamics algorithms are often formulated in a relatively ad hoc manner in which independent discretizations are proposed for mass, momentum, energy, and so forth. We show that, once discretizations for mass and momentum are stated, the remaining discretizations are very nearly uniquely determined, so there is very little latitude for variation. As has been known for some time, the kinetic energy discretization must follow directly from the momentum equation; and the internal energy must follow directly from the energy currents affecting the kinetic energy. A fundamental requirement (termed isentropicity) for numerical hydrodynamics algorithms is the ability to remain on an isentrope in the absence of heating or viscous forces and in the limit of small timesteps. We show that the requirements of energy conservation and isentropicity lead to the replacement of the usual volume calculation with a conservation integral. They further forbid the use of higher order functional representations for either velocity or stress within zones or control volumes, forcing the use of a constant stress element and a constant velocity control volume. This, in turn, causes the point and zone coordinates to formally disappear from the Cartesian formulation. The form of the work equations and the requirement for dissipation by viscous forces strongly limits the possible algebraic forms for artificial viscosity. The momentum equation and a center-of-mass definition lead directly to an angular momentum conservation law that is satisfied by the system. With a few straightforward substitutions, the Cartesian formulation can be converted to a multidimensional curvilinear one. The formulation in 2D symmetric geometry preserves rotational symmetry.

4503 Nuclear Explosion Detection

Refer also to citation(s) 21558

22145 (UCRL-CR–120949) **Comparison of the effects in the rock mass of large-scale chemical and nuclear explosions. Final technical report, June 9, 1994–October 9, 1994.** Spivak, A.A. Lawrence Livermore National Lab., CA (United States). Apr 1995. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013381. Source: OSTI; NTIS; GPO Dep.

It was found that in the first approximation the mechanical effect of underground nuclear explosion is analogous to the effect of chemical explosion. Really qualitative analysis shows that accompanying mechanical effects of nuclear and chemical explosions are the same: in the both cases explosion consequences are characterized by formation of the camouplet cavity (crater after explosion near free surface), destruction of the rock massif near explosion centre, creation of the stress wave, which forms seismoexplosive effect a long distance from explosion epicentre. Qualitative likeness of underground nuclear explosions and chemical explosions is the base of modelling the mechanical effects of the underground nuclear explosion. In this paper we'll compare two explosions: nuclear (15-04-84) and chemical (27.06.95) with large power. These explosions were realized at the same geological conditions at Degelen test area, which is a part of the Semipalatinsk Test Site. In the case of the nuclear explosion, the charge was disposed in the face of the deep horizontal gallery. The charge of the chemical explosion was a semisphere from explosives at the rock massif surface. In the both case rock massif behavior after explosions was investigated at underground conditions (in the case of chemical explosion – in the long underground excavation from explosion epicentre). Mechanical effects from the nuclear and chemical explosions were investigated with the same methods. The changes in geological medium after a large-scale explosive actions will be analyzed in detail too. Investigations of the influence of tectonic energy on the mechanical effects after underground nuclear, explosions represents the main interest. In this paper we'll discuss this question on the data from underground nuclear explosion, realized 08.09.89 in the deep well at the Balapan test area, at the Semipalatinsk Test Site.

22146 (UCRL-ID–120666) **VILLE containment data report.** Stubbs, T.; Heinle, R. Lawrence Livermore National Lab., CA (United States). Mar 1995. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013272. Source: OSTI; NTIS; GPO Dep.

The VILLE event was detonated in hole U4am of the Nevada Test Site as indicated in Fig. 1.1. A plan view map of the local region around hole U4am indicating the inferred faults and drill holes is shown in figure 1.2. The device had a depth-of-burial of 293 m in the alluvium of Area 4, about 240 m above the standing water level (SWL), as shown in Figure 1.3. Stemming of the 2.44 m diameter emplacement hole followed the plan shown in Fig. 1.4. A log of the stemming operations was maintained by Holmes and Narver. Detonation time was 08:15 PDT on June 13, 1985 and about 28 minutes later the chimney collapsed to the surface leaving a crater with a mean radius of 59.7 m and a maximum depth of 17.3 m. No radiation arrivals were detected in the emplacement hole and the VILLE containment was considered successful. Three of the five stemming plugs (the first, fourth and fifth) were composed of coarse gypsum aggregate in a gypsum cement slurry.

Each of these three gypsum-filled-aggregate (GFA) plugs was monitored during emplacement with arrays of conductivity probes and thermistors. The remaining two plugs were soft, coal tar aggregate (CT/A) gas seal membranes having a thickness of about 1.5 m sandwiched between layers of fines material. A layer of CT/A was poured on the top of each of the top two GFA plugs.

4505 Strategic Defense Initiative

22147 (LA-SUB–95-14) **Criteria for choosing among competing alternatives for ATBM defenses. Final report.** Los Alamos National Lab., NM (United States); Center for Strategic and International Studies, Washington, DC (United States). [1995]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011621. Source: OSTI; NTIS; GPO Dep.

The Center for Strategic and International Studies (CSIS) established an executive review panel to assess the paper written by Peter Zimmerman. The panel consisted of experts on theater missile defenses, U.S. relations with former Soviet Union/Russia, the ABM compliance issues. The panel was NOT able to reach a consensus on the issues raised by the paper. NOR was it able to validate the criteria developed therein. A majority of the panel took exception to many to the facts, findings, and conclusions of the paper. The major points under dispute are: the characterization of the threat, the definition of technical risk, system performance requirements, limits on ATBM systems imposed by the ABM Treaty, Congressional views, cost and IOC dates. The issues are discussed in detail in this review.

22148 (UCRL-ID–119013) **Various ATA notes: 60, 79, 116, and 136.** Caporaso, G.; Denhoy, B.; Hanson, C.L.; Chambers, F.W. Lawrence Livermore National Lab., CA (United States). 24 Oct 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012105. Source: OSTI; NTIS; GPO Dep.

The purpose of note No. 60 is to outline the reasons why it is important to develop and test a steam ejector for use on the differential pumping station. Note No. 79 discusses two stream instability of an electron beam in the differential pumped transport section. Note No. 116 covers the steam ejector prototype unit (Stage 1). And lastly, note No. 136 presents the results of a survey done to find the commercially available equipment to meet differential pump requirements for the Advanced Test Accelerator.

4506 Chemical and Biological

Refer also to citation(s) 21542, 21696

22149 (ANL/EA/CP–84361) **RCRA delisting of agent-decontaminated waste at Dugway Proving Ground.** Kimmell, T.A. (Argonne National Lab., IL (United States)); Anderson, A.W.; Green, D.R.; Lopez, J.D. Argonne National Lab., IL (United States); Army Test and Evaluation Command, Dugway, UT (United States). Apr 1995. 7p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9504171–1: 21. annual environmental symposium of the American Defense Preparedness Association, San Diego, CA (United States), 18-21 Apr 1995). Order Number DE95012924. Source: OSTI; NTIS; GPO Dep.

The State of Utah has declared residues resulting from the demilitarization, treatment, cleanup, testing of military chemical agents to be hazardous wastes. These residues are listed as hazardous waste in Utah and several other States, but are not listed under regulations established by the US Environmental Protection Agency (EPA) pursuant to the Federal Resource Conservation and Recovery Act (RCRA), the primary law governing management of hazardous waste in the US These residues are identified as hazardous waste due to corrosivity, reactivity, chronic toxicity, and acute toxicity, and are designated as Hazardous Waste No. F999. The RCRA regulations (40 CFR 260-280), the Utah Administrative Code (R-315), and other State hazardous waste programs list specific wastes as hazardous, but allow generators to petition the regulator to "delist" if it can be demonstrated that such wastes are not hazardous. The US Army Test and Evaluation Command (TECOM) has initiated a project with the Argonne National Laboratory to demonstrate that certain categories of F999 residues are not hazardous waste and to achieve delisting. The initial focus is on delisting specific residues from decontamination of wastes generated during materials testing activities and contaminated soil at the US Army Dugway Proving Ground (DPG), Utah. This activity is referred to as Phase I of the delisting program. Subsequent phases of the delisting program will address additional waste streams at DPG and other Army installations. The purpose of this paper is to outline the Phase I TECOM delisting effort at DPG, identify some of the important technical issues associated with the delisting, and to discuss overall progress to date.

22150 (UCRL-ID–119330) **Energy deposition in a biological submunition warhead by low-yield nuclear interceptors.** Mendelsohn, E. Lawrence Livermore National Lab., CA (United States). Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012109. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Monte Carlo calculations have been completed in which the authors exposed a model of a biological target warhead, containing 42 water-filled canisters, to the radiation output of a generic nuclear fission or fusion warhead. Water is used to simulate biological agent in aqueous solution. In the calculations this biological warhead was irradiated with a fission or a fusion point source positioned 3 meters from the target. The yield of this source was normalized to 100 tons. The resulting calculated energy depositions due to neutrons and gamma rays were tallied. A comparison is made with previous calculations using a target warhead containing a chemical agent. Tabular and graphical calculational results are provided.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 20756, 21393

22151 (ETDE-DE–149) **Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie. Annual report 1994.** Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany). [1995]. 215p. (In German). Order Number DE95785473. Source: OSTI; NTIS (US Sales Only).

From a scientific point of view the institute's activities include the following topics: - Sources, occurrence and interactive processes: chemicals - environment(al compartments); - Exposure protection of humans and of the environment; - Applied ecology focussing on ecotoxicology and ecophysiology; - Environmental information and assessment systems: substances, products, technologies. (orig./SR)

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 20574, 20752, 20980, 20984, 21085, 21161, 21162, 21166, 21241, 21346, 21348, 21350, 21351, 21362, 21364, 21379, 21456, 21458, 21463, 21482, 21483, 21530, 21665, 21695, 21722, 22278, 22279, 22280, 22282, 22283, 22284, 22292, 22298, 22299, 22325, 22327, 22465, 22475, 22477, 22481, 22489, 22500, 22505

22152 (ANL/DIS/CP–85637) **The Tracking and Analysis Framework (TAF): A tool for the integrated assessment of acid deposition.** Bloyd, C.N. (Argonne National Lab., IL (United States)); Henrion, M.; Marnicio, R.J. Argonne National Lab., IL (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950196–1: Air & Waste Management Association (AWMA) conference on acid rain & electric utilits: permits, allowances, monitoring & meteorology, Tempe, AZ (United States), 23-25 Jan 1995). Order Number DE95013497. Source: OSTI; NTIS; INIS; GPO Dep.

A major challenge that has faced policy makers concerned with acid deposition is obtaining an integrated view of the underlying science related to acid deposition. In response to this challenge, the US Department of Energy is sponsoring the development of an integrated Tracking and Analysis Framework (TAF) which links together the key acid deposition components of emissions, air

transport, atmospheric deposition, and aquatic effects in a single modeling structure. The goal of TAF is to integrate credible models of the scientific and technical issues into an assessment framework that can directly address key policy issues, and in doing so act as a bridge between science and policy. Key objectives of TAF are to support coordination and communication among scientific researchers; to support communications with policy makers, and to provide rapid response for analyzing newly emerging policy issues; and to provide guidance for prioritizing research programs. This paper briefly describes how TAF was formulated to meet those objectives and the underlying principals which form the basis for its development.

22153 (ANL/ER/CP–84064) **A technique using the wavelet transform to identify and isolate coherent structures in the planetary boundary layer.** Coulter, R.L. (Argonne National Lab., IL (United States)); Li, B.L. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950381–3: 11. symposium on boundary layers and turbulence, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95011956. Source: OSTI; NTIS; GPO Dep.

A dominant feature of the convective planetary boundary layer (PBL) is the presence of coherent structures often referred to as thermal plumes. These are regions of buoyant, rising air whose maximum height is limited by the capping inversion at the top of the mixed layer. They range in diameter from 0.05 to 5 km or more, scale with the height of the mixed layer (z_i), are the large-scale source of energy input to the turbulence spectrum, and provide the mechanism for transferring energy from the surface through the mixed layer and into the capping inversion. When conditions are appropriate, fair-weather cumulus clouds develop at the tops of the thermal plumes. In this sense, small cumulus clouds provide a visual description of the size, location, and lifetime of mature, active thermal plumes in a deep mixed layer. Plume development is not limited to plumes associated with cumulus clouds. Although the horizontal pattern of thermals is often apparently randomly oriented, Ferrare et al. showed that thermals can be organized into "thermal streets," similar to cloud streets, but without clouds. The authors also used scanning lidar data to show that the horizontal cross section of thermals is roughly elliptical, with the major axis along the direction of the wind shear vector. Traveling with the mean wind, thermal plumes act as a conduit for heat and moisture between the surface and the lower troposphere. Thermal plumes can be defined either by patterns of rising air or as organized regions of enhanced "thermal turbulence" that can be depicted by large values of the temperature structure parameter, C_T^2 which can be evaluated with remote sensing instruments such as radar profilers and sodars. This more general description includes some regions of downward moving air and entrainment into the plume.

22154 (ANL/ER/CP–84065) **Surface heat flux data from energy balance Bowen ratio systems.** Wesely, M.L.; Cook, D.R.; Coulter, R.L. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9503104–2: 9. symposium on meteorological observations and instrumentation, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95012293. Source: OSTI; NTIS; GPO Dep.

The 350 x 400 km domain of the Atmospheric Radiation Measurement (ARM) Program's Clouds and Radiation Testbed (CART) site in the southern Great Plains is equipped with 10 energy balance Bowen ratio (EBBR) stations at grassland sites; they measure the net radiation, ground heat flux, and temperature/humidity differences between 1.0 and 2.0 m heights. The latter differences provide estimates of the geometric Bowen ratio (β), which are used to estimate sensible and latent heat fluxes. This paper addresses the problem that occurs when the value of β is near -1 and to demonstrate the effectiveness of the EBBR stations in collecting energy flux data at the CART site.

22155 (ANL/ER/CP–84206) **An evaluation of ARM radiosonde operational performance.** Lesht, B.M. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9503104–3: 9. symposium on meteorological observations and instrumentation, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95012446. Source: OSTI; NTIS; GPO Dep.

Because the ARM (Atmospheric Radiation Measurement) program uses data from radiosondes for real-time quality control and sensitive modeling applications, it is important to have a quantitative measure of the quality of the radiosonde data themselves. Two methods have been tried for estimating the quality of radiosonde data: comparisons with known standards before launch and examination of pseudo-replicate samples by single sensors aloft. The ground check procedure showed that the ARM radiosondes are within manufacturer's specifications for measuring relative humidity; procedural artifacts prevented verification for temperature. Pseudo-replicates from ascent and descent suggest that the temperature measurement is within the specified ∓ 0.2 C. On average ascent and descent data are similar, but detailed structure may be obscured on descent by loss of sampling density, and the descent involves other uncertainties.

22156 (ANL/ER/CP–84929) **Wavelet analysis of atmospheric turbulence structures: What can we gain from this new technique?.** Gao, W. (Argonne National Lab., IL (United States). Environmental Research Div.); Li, B.L. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950381–4: 11. symposium on boundary layers and turbulence, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95011955. Source: OSTI; NTIS; GPO Dep.

The authors examined three specific methods for using the wavelet transform to derive information on the turbulence structure in the atmospheric boundary layer from raw data. The scale-time cross section method yields a qualitative picture of turbulence structures occurring at different times and different scales, the wavelet variance method provides a relatively objective estimate of principal scales associated with organized structures, and the wavelet cross correlation helps in identifying motions that are most important in turbulent transport and spatial coherence. The wavelet analysis can also be used to decompose the data for different scales and to detect coherent structures objectively by using the transform coefficient at the principal scale detected by the variance method (Collineau and Brunet, 1993; Coulter and Li, 1995). These methods can improve their capability to unfold the data for hidden information that is difficult to obtain from traditional spectral analysis and thus can provide a useful tool for understanding multiscale phenomena in the atmospheric boundary layer.

22157 (ANL/ER/CP–86004) **Using remotely sensed planetary boundary layer variables as estimates of areally averaged heat flux.** Coulter, R.L.; Martin, T.J.; Holdridge, D.J. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503140–5: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95012402. Source: OSTI; NTIS; GPO Dep.

Homogeneity across the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site is an issue of importance to all facets of the Atmospheric Radiation Measurements (ARM) program. The degree to which measurements at the central facility can be used to verify, improve, or develop relationships in radiative flux models that are subsequently used in Global Circulation Models (GCMs), for example, is tied directly to the representativeness of the local measurements at the central facility for the site as a whole. The relative variation of surface energy budget terms over a 350- km X 400km domain such as the SGP CART site can be extremely large. The Planetary Boundary Layer (PBL) develops as a result of energy inputs from widely varying surfaces. The lower atmosphere effectively integrates the local inputs; measurements of PBL structure can potentially be used for estimates of surface heat flux over scales on the order of tens of kilometers. This project is focusing on two PBL quantities that are intimately tied to the surface heat flux: (1) the height of the mixed layer, z, that grows during daytime due to sensible heat flux input from the surface; and (2) the convective velocity scale, normally a scaling parameter defined by the product of the sensible heat flux and z, but in this

case defined by coherent structures that connect the surface layer and the capping inversion that defines z.

22158 (ANL/ER/CP–86324) **Aspects of the quality of data from SGP cart site broadband radiation sensors.** Splitt, M.E. (Oklahoma Univ., Norman, OK (United States). Cooperative Inst. for Mesoscale Meteorological Studies); Wesely, M.L. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503140–7: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95012274. Source: OSTI; NTIS; GPO Dep.

This report presents details of the performance of broadband radiometers the the southern Great Plains (SGP) cloud and radiation testbed (CART) site to estimate the uncertainties of irradiance observations. Net radiation is observed with net radiometer in the energy balance Bowen ratio station at the central facility and compared with the net radiation computed as the sum of component irradiances recorded by nearby pyranometers and pyrgeometers. This paper observes the uncertainties of readings from net radiometers which are known to be substantial.

22159 (ANL/ER/PP–85343) **Longwave radiative forcing by aqueous aerosols.** Gaffney, J.S. (Argonne National Lab., IL (United States). Environmental Research Div.); Marley, N.A. Argonne National Lab., IL (United States). Jan 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012205. Source: OSTI; NTIS; GPO Dep.

Recently, a great deal of interest has been focused on the role of aerosols in climatic change because of their potential cooling impacts due to light scattering. Recent advances in infrared spectroscopy using cylindrical internal reflectance have allowed the longwave absorption of dissolved aerosol species and the associated liquid water to be accurately determined and evaluated. Experimental measurements using these techniques have shown that dissolved sulfate, nitrate, and numerous other aerosol species will act to cause greenhouse effects. Preliminary calculations indicate that the longwave climate forcing (i.e., heating) for sulfate aerosol will be comparable in magnitude to the cooling effect produced by light scattering. However, more detailed modeling will clearly be needed to address the impact of the longwave forcing due to aerosols as a function of atmospheric height and composition. Their work has shown that aerosol composition will be important in determining longwave forcing, while shortwave forcing will be more related to the physical size of the aerosol droplets. On the basis of these studies, it is increasingly apparent that aerosols, fogs, and clouds play a key role in determining the radiative balance of the atmosphere and in controlling regional and global climates.

22160 (ANL/ES/CP–84927) **Mobile source emission control cost-effectiveness: Issues, uncertainties, and results.** Wang, M.Q. (Argonne National Lab., IL (United States). Center for Transportation Research). Argonne National Lab., IL (United States). 1 Dec 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950188–1: Reformulated fuels conference, Houston, TX (United States), 31 Jan - 2 feb 1995). Order Number DE95012215. Source: OSTI; NTIS; GPO Dep.

Emissions from mobile sources undoubtedly contribute to US urban air pollution problems. Consequently, mobile source control measures, ranging from vehicle emission standards to reducing vehicle travel, have been adopted or proposed to help attain air quality standards. To rank various mobile source control measures, various government agencies and private organizations calculate cost-effectiveness in dollars per ton of emissions reduced. Arguments for or against certain control measures are often made on the basis of the calculated cost-effectiveness. Yet, different studies may yield significantly different cost-effectiveness results, because of the various methodologies used and assumptions regarding the values of costs and emission reductions. Because of the methodological differences, the cost-effectiveness results may not be comparable between studies. Use of incomparable cost-effectiveness results may result in adoption of ineffective control measures. This paper first discusses some important methodological issues involved in cost-effectiveness calculation for mobile sources and proposes appropriate, systematic methods for dealing with these issues. Various studies have been completed recently to evaluate the cost-effectiveness of mobile source emission control measures. These studies resulted in wide variations in the cost-effectiveness for same control measures. Methodological assumptions used in each study are presented and, based on the proposed methods for cost-effectiveness calculation, adjustments are applied to the original estimates in each study to correct inappropriate methodological assumptions and to make the studies comparable. Finally, mobile source control measures are ranked on the basis of the adjusted cost-effectiveness estimates.

22161 (BNL–60197) **Comparison of seasonal and zonal patterns of the direct and indirect radiative forcing of climate by aerosols.** Wagener, R.; Schwartz, S.E. Brookhaven National Lab., Upton, NY (United States). Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9503140–1: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95010896. Source: OSTI; NTIS; GPO Dep.

Aerosols have a climatically significant influence on the absorption of shortwave radiant energy in the troposphere, both directly through enhanced scattering of sunlight in the absence of clouds and indirectly through their fundamental role in controlling cloud microphysical properties. Quantitative estimates of the magnitudes of both effects are very uncertain. To possibly distinguish these effects, the authors calculated the monthly and zonally averaged forcing for a spatially uniform and seasonally constant perturbation in aerosol and cloud optical properties.

22162 (BNL–61363) **Reliability, CO_2 concentration control, and CO_2 gas use of the FACE facility at ETH in 1993 and 1994.** Nagy, J. (Brookhaven National Lab., Upton, NY (United States)); Hendrey, G.R.; Lewin, K.F.; Blum, H.; Koller, S.R. Brookhaven National Lab., Upton, NY (United States). Jan 1995. 75p. Sponsored by USDOE, Washington, DC (United States);Ecole Polytechnique Federale, Lausanne (Switzerland). DOE Contract AC02-76CH00016. (CONF-950296–1: Swiss FACE meeting, Zurich (Switzerland), 2-3 Feb 1995). Order Number DE95012305. Source: OSTI; NTIS; GPO Dep.

Free-Air Carbon dioxide Enrichment (FACE) is one technique of many used to assess the effects of elevated concentrations of CO_2 on plant communities. One primary advantage of FACE techniques is that they provide fumigation over large areas under essentially normal conditions compared to other techniques such as greenhouses, open-top chambers, etc. The FACE design developed by Brookhaven National Laboratory (BNL) is distinguished from other free-air designs by the introduction of a pre-diluted fumigation gas only at the periphery of an experimental plot and by relatively rapid, closed-loop control of treatment level based on gas concentration, wind speed, and wind direction. This report presents preliminary results concerning facility performance during 1993 and 1994 within three treatment arrays during FACE operations at the Eschikon Experimental Station of the Swiss Federal Institute of Technology, Institute for Plant Sciences, Zurich, Switzerland. The report includes summaries of data describing system reliability, temporal concentration control, spatial concentration control, $C0_2$ use, and ambient $C0_2$ concentrations.

22163 (BNL–61604) **Mitigation options for accidental releases of hazardous gases.** Fthenakis, V.M. Brookhaven National Lab., Upton, NY (United States). [1995]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950927–3: International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials, New Orleans, LA (United States), 26-29 Sep 1995). Order Number DE95011349. Source: OSTI; NTIS; GPO Dep.

The objective of this paper is to review and compare technologies available for mitigation of unconfined releases of toxic and flammable gases. These technologies include: secondary confinement, deinventory, vapor barriers, foam spraying, and water

sprays/monitors. Guidelines for the design and/or operation of effective post-release mitigation systems and case studies involving actual industrial mitigation systems are also presented.

22164 (BNL–61815) **Enhanced shortwave cloud radiative forcing due to anthropogenic aerosols.** Schwartz, S.E. (Brookhaven National Lab., Upton, NY (United States)); Slingo, A. Brookhaven National Lab., Upton, NY (United States); Meteorological Office, Bracknell (United Kingdom). Hadley Centre for Climate Prediction and Research. May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. UKingdom Department of the Environment PECD 7/12/37. (CONF-950001–1: NATO advanced research workshop on clouds, chemistry and climate, Heidelberg (Germany), 1995). Order Number DE95013319. Source: OSTI; NTIS; GPO Dep.

It has been suggested that anthropogenic aerosols in the troposphere can influence the microphysical properties of clouds and in turn their reflectivity, thereby exerting a radiative influence on climate. This article presents the theoretical basis for of this so-called indirect forcing and reviews pertinent observational evidence and climate model calculations of its magnitude and geographical distribution. We restrict consideration to liquid-water clouds.

22165 (CONF-930133–13) **Simulations of convection using ARM data.** Randall, D.A.; Xu, Kuan-Man. Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science. [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER61363. From 73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993. Order Number DE95008980. Source: OSTI; NTIS; GPO Dep.

Short communication. CLIMATIC CHANGE/computerized simulation; NATURAL CONVECTION/computerized simulation; CLOUD COVER; TROPOSPHERE; CONDENSATION NUCLEI

22166 (CONF-930346–7) **Appendix B: A practical model for the calculation of multiply scattered lidar returns.** Eloranta, E.W. Wisconsin Univ., Madison, WI (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract FG02-90ER61058. Grant N00014-91-J-1558. From Optical Society of America meeting on optical remote sensing of the atmosphere; Salt Lake City, UT (United States); 8-12 Mar 1993. Order Number DE95013015. Source: OSTI; NTIS; GPO Dep.

Lidar results are typically analyzed using an equation which assumes all photons contributing to the return have been singly scattered. Lidar pulses returned from clouds often encounter large optical depths within a short distance of the cloud boundary and many of the received photons are likely to result from multiple scattering. This paper presents an equation to predict the multiply scattered return. The equation is easy to solve on a small computer and allows specification of the scattering cross section and the scattering phase function as a function of penetration depth into the cloud. Atmospheric clouds are made of particles which are large compared to the wavelength of visible and near infrared lidars. Optical absorption by particles is typically negligible at these wavelengths. The solution derived in this paper applies to these conditions. The derivation is an approximation which considers only the contribution due to multiple small angle forward scatterings coupled with one large angle scattering which directs the photon back towards the receiver.

22167 (CONF-940115–33) **Impact of cloud microphysics on cloud-radiation interactions in the CSU general circulation model.** Fowler, L.D.; Randall, D.A. Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science. [1995]. 5p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG02-91ER61218. Grant ATM-8907414. From 74. American Meteorological Society annual meeting; Nashville, TN (United States); 23-28 Jan 1994. Order Number DE95008979. Source: OSTI; NTIS; GPO Dep.

Our ability to study and quantify the impact of cloud-radiation interactions in studying global scale climate variations strongly relies upon the ability of general circulation models (GCMs) to simulate the coupling between the spatial and temporal variations of the model-generated cloudiness and atmospheric moisture budget components. In particular, the ability of GCMs to reproduce the geographical distribution of the sources and sinks of the planetary radiation balance depends upon their representation of the formation and dissipation of cloudiness in conjunction with cloud microphysics processes, and the fractional amount and optical characteristics of cloudiness in conjunction with the mass of condensate stored in the atmosphere. A cloud microphysics package which encompasses five prognostic variables for the mass of water vapor, cloud water, cloud ice, rain, and snow has been implemented in the Colorado State University General Circulation Model (CSU GCM) to simulate large-scale condensation processes. Convection interacts with the large-scale environment through the detrainment of cloud water and cloud ice at the top of cumulus towers. The cloud infrared emissivity and cloud optical depth of the model-generated cloudiness are interactive and depend upon the mass of cloud water and cloud ice suspended in the atmosphere. The global atmospheric moisture budget and planetary radiation budget of the CSU GCM obtained from a perpetual January simulation are discussed. Geographical distributions of the atmospheric moisture species are presented. Global maps of the top-of-atmosphere outgoing longwave radiation and planetary albedo are compared against Earth Radiation Budget Experiment (ERBE) satellite data.

22168 (CONF-940738–Summ.) **Twenty-third DOE/NRC Nuclear Air Cleaning and Treatment Conference.** Bellamy, R.R. (Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.); Hayes, J.J.; First, M.W. Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.; Nuclear Regulatory Commission, Washington, DC (United States). 24 Mar 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-94EH89439. From 23. DOE/NRC nuclear air cleaning and treatment conference; Buffalo, NY (United States); 25-28 Jul 1994. Order Number DE95009112. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the details of the Nuclear Air Cleaning and Treatment Conference held in Buffalo, New York during July 1994. Topics discussed include: nuclear air cleaning codes and standards; waste disposal; particulate filter developments; sampling and monitoring of process and effluent streams; off-gasses from fuel reprocessing; adsorbents and adsorption; accident control and analysis; revised source terms for power plant accidents; and the highlight of the conference concerned operations at the West Valley Doe facility where construction is underway to solidify radioactive wastes.

22169 (CONF-9409357–Summ.) **1995 Protocol for Working Group VIII: Influence of environmental changes on climate. US-Russia agreement on cooperation in the field of protection of the environment and natural resources. Final report, January 1, 1994–December 31, 1994.** National Oceanic and Atmospheric Administration, Boulder, CO (United States); US/Russia Agreement on Cooperation in the Field of Protection of the Environment and Natural Resources (United States). Working Group VIII. [1995]. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI02-94ER61759. From 19. annual meeting of Working Group VIII of the Joint US-Russian Committee on Cooperation in the field of protection of the environment and natural resources; St. Petersburg (Russian Federation); 11-17 Sep 1994. Order Number DE95011483. Source: OSTI; NTIS; GPO Dep.

Cooperative research programs of Russia and the United States concerned with global warming and climatic change are briefly described.

22170 (ES/ER/TM–145) **Technical specification for transferring ambient air monitoring data to the Oak Ridge Environmental Information System (OREIS).** Oak Ridge Environmental Information System (OREIS) Program, TN (United States). Jun 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014026. Source: OSTI; NTIS; GPO Dep.

In September 1994, a team was formed to develop, document, and implement technical specifications for transmitting ambient air environmental compliance and monitoring data to the Oak Ridge Environmental Information System (OREIS). The approach used to

transmit this data is documented in the "Plan for Integrating Environmental Compliance and Monitoring Data into OREIS." This plan addresses the consolidated data requirements defined by the Federal Facility Agreement (FFA) and the Tennessee Oversight Agreement (TOA) as they pertain to environmental compliance and monitoring data maintained by Energy Systems' Oak Ridge Environmental Management organizations. Ibis document describes. the requirements, responsibilities, criteria, and format for transmitting ambient air compliance and monitoring data to OREIS.

22171 (ETDE-DE–112) **The implementation of the semi-implicit scheme in cell-integrated semi-Lagrangian models.** Report - Max-Planck-Institut fuer Meteorologie, v. 156. Machenhauer, B.; Olk, M. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). Feb 1995. 37p. Order Number DE95778048. Source: OSTI; NTIS (US Sales Only).

The cell-integrated semi-Lagrangian method, in which trajectories from the corner points of a grid cell define its extent at a previous time, may be applied to a set of equations on Lagrangian form derived from the complete set of primitive equations to construct a numerical model which conserves exactly the discrete forms of the global integrals constraints of mass, momentum, entrophy and total energy. Due to the fulfilment of these integral constraints one should expect the numerical model to be absolutely stable. Experiments with a simple one-dimensional shallow water model show, however, that a time step dependent instability develops when a CFL criterion for gravity waves is exceeded. Analysis of experiments with one-dimensional shallow water models unveil the mechanism of the instability. Using again for simplicity one-dimensional models a main achievement is a successful implementation of the semi-implicit time stepping scheme in the cell-integrated models. (orig.)

22172 (GSF–39/93, pp. 30-35) **Wet deposition in Slovenia from 1980-1992.** Lesnjak, M. (Hydrometeorologisches Inst. der Republik Slowenien, Ljubljana (Slovenia)); Rajh-Alatic, Z. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

This paper contains the analysis of data from the Slovenian measuring grid for the observation of precipitation quality from 1980-1992. Sampling took place monthly with so-called "bulk"-samplers. Precipitation in Slovenia shows a mean content of anions 40-50% HCO_3^-, 35-45% SO_4^{2-}, 10-30%Cl , 5-10% NO_3^- and cations 50% Ca^{2+}, 20% Mg^{2+}, 20% NH_4^+, 10% K^+ Na^+ , stated in terms of mcal/l . Due to the neutralising effect of dust particles in the there were more air alkaline samples with a ph-value above 5.6 except in the vicinity of coal-fired power stations where there is greater carry-over of acids from the atmosphere. Between 1980 and 1992 acid carry-over increased at all measuring stations except Masun where no visible changes were registered. Sulfate concentrations in connurbations and industrial areas increased over this period of time which there were no changes in rural areas. Nitrate concentrations increased at most sites. Sulphur and nitrogen deposition was relatively high and may be a considerable danger to the forest ecosystems especially in the region of Zavodjne with its granite soils. (orig/EW)

22173 (GSF–39/93, pp. 36-48) **Carry-over of ecologically hazardous substances through wet deposition in the Bavarian Northern Alps.** Hahn, J. (Fraunhofer-Institut fuer Atmosphaerische Umweltforschung (IFU), Garmisch-Partenkirchen (Germany)); Sladkovic, R. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

In the northern alpine regions of Bavaria there is usually strong precipitation due to westerly and northerly winds. Considerable amounts of ecologically hazardous substances are thus carried into the local ecosystems. So far, there is hardly any information or data on quantitites and types of these trace substances or on the influence of meteorological parameters on trace pollutant carry-over. The only measuring programme which systematically recorded wet deposition in the northern Alpine region of Bavaria was carried out by the Fraunhofer-Institute for atmospheric environmental research (IFU). The measuring programme which was based on a grid of six measuring stations along the northern Alpine front in Bavaria from the Hochgrat (Allgaeu) to the Predigtstuhl (Bad Reichenhall) with the focus in the area of Garmisch-Partenkirchen had to cut down by the end of 1989 after considerable financial difficulties had arisen. Thereafter, precipitation could be studied only in the area of Garmisch-Partenkirchen. This study describes the results from the Garmisch-Partenkirchen station. Event-based collected samples of precipitation at this and at all other stations were tested for ph-value, electric conductivity, the most frequent anorganic cations and anions and the trace metals zink, cadmium, lead and copper. Annual and seasonal precipitation quantities and the carry-over rates of the different pollutants were calculated from these data. Time series of a number of ecologically hazardous pollutants were thus obtained, they are discussed in the following. (orig.EW)

22174 (GSF–39/93, pp. 58-63) **Long-term monitoring of polluted forest ecosystems in Bavaria forest climate stations.** Kennel, M. (Bayerische Landesanstalt fuer Wald und Forstwirtschaft, Freising (Germany)); Lechler, H.H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The measuring grid "forest climate stations in Bavaria" is a long-time monitoring which creates a broad basis of data relevant to climate and hydrology of forst ecosystem research and also to foresting (prospecting of sites, protection of forests). As the essential forests of Bavaria and the most widespread tree types are monitored it is possible to assess the effects of anthropogenic stresses such as carry-over of air pollutants or expected changes of the climate. Forest climate stations are therefore an important instrument of what is known as preventive environmental protection of forests. Numerous basic measuring series and the extendable infrastructure of measuring stations offer possiblilities of further interdisciplinary cooperation in research and also serve to bundle and intensify research in Bavarian forests. (orig./EW)

22175 (GSF–39/93, pp. 78-89) **Wet deposition in alpine forest areas.** Novo, A. (ENEL S.p.A. DSR/CRTN, Mailand (Italy)); Buffoni, A.; Ziliani. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE*

ALP and ALPEN-ADRIA countries. Proceedings. Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/atmospheric precipitations; FORESTS/pathological changes; ITALY/alps; FORESTS; AIR POLLUTION; ITALY; ALPS; DEPOSITION; PH VALUE; NITROGEN; SULFUR; SOILS

22176 (GSF–39/93, pp. 126-134) **Carry-over of trace pollutants through fog on forests.** Winkler, P. (Deutscher Wetterdienst, Meteorologisches Observatorium, Hamburg (Germany)); Pahl, S. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Deposition of pollutants contained in fog to conifers is one important path of carry-over apart from wet deposition. In order to estimate deposition of pollutants from cloud water to conifer forests the liquid water content was registered at the Feldberg/Black Forest over a period of 21 months. A new sight- LWC-relation could be parametrised. With these parameters and the measured values of pollutants contained in fogs we calculated deposition of water quantities at several mountain stations. Fog water samples show higher concentration of pollutants than rainfall. Over a whole year concentrations of sulfate and nitrate when calculated for a uniform liquid water content show a peak in May. Comparative calculations of the flow of cloud water and contents on a forest of conifers were carried out for the period 1982-1991. In higher mountaneous regions deposition of trace substances though fog to needle trees was to be found to be as high as from rainfall. (orig./EW)

22177 (GSF–39/93, pp. 135-144) **Growth of pollution and deposition during fogs.** Ziereis, H. (Kernforschungszentrum Karlsruhe GmbH, Lab. fuer Aerosolphysik und Filtertechnik I, Karlsruhe (Germany)); Lammel, G.; Metzig, G. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Several orographic clouds at heavily polluted (Rhine valley, Filder plains) and less polluted sites (Black Forest, Vosges) were monitored. In order to study carry-over of acids and acid formation in fog one tried to established a full chemical characterisation of the multiphase system fog. Fog water and the particle phase - e.g. particles which have not grown into drops - were collected and chemically analysed before, during and after fog. Concentration of ammonia, nitric acid and hydrogen peroxide in the gas phase was determined and concentrations of O_3 NO_x and SO_2 were used for interpretation. Composition of fog water showed strong, site-dependent differences. Pollution was highest in connurbations. Aas a rule, ammonia, nitrate, sulfate and total carbon content were the most important pollutants contained in fog water and in the particle phase. During fogs too, the particle -bound form of these pollutants was found to be most frequent. Trace material content in fog water can be explained by wash-out of aerosol particles during fog formation and by chemical transformation in the droplets. (orig./EW)

22178 (GSF–39/93, pp. 145) **Dry deposition in the Ziller valley.** Gregori, M. (Inst. fuer Analytische Chemie der Technischen Univ. Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication SOILS/atmospheric precipitations; SOILS/deposition; AUSTRIA/soils; FORESTS; SOILS; DEPOSITION; AUSTRIA; SEASONAL VARIATIONS; OZONE; SULFUR COMPOUNDS; NITROGEN COMPOUNDS; AIR POLLUTION

22179 (GSF–39/93, pp. 146-156) **Long-distance transport of air pollution in Central Europe.** Schoepp, W. (IIASA - International Inst. for Applied Systems Analysis, Laxenburg (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The first step of any air-pollution model consists in recording emissions. While the CORINE-project supplies reliable and detailed data on emissions within the EC since 1985, there has been no similar programme for the remaining countries of Central Europe. This gap has now been filled. Data are available to model developers from the IIASA Status Report "Emission of Air Pollutants in the Region of the Central European Initiative - 1988". For the calculation of long-distance transport the IIASA RAINS-model (Regional Acidification Information System) uses a transport matrix derived from the results of the EMEP-programme. RAINS can also use other transport models. The aim of the RAINS model is to compare emissions with the effect of immissions in order to help with political decision-making. The model includes the following effects: acidification of soils, euthrophication, direct effects on the forests via needles and leaves. (orig./EW)

22180 (GSF–39/93, pp. 157-167) **Results of immission measuring flights across the Alps.** Schlager, H. (DLR, Inst. fuer Physik der Atmosphaere, Oberpfaffenhofen (Germany)); Graf, J.; Krautstrunk, M. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Distribution and origin of pollutants in the Alpine region were studied with airbourne measurements. At the same time, model simulations of the chemical transformation and transport of noxious gases were carried out. High degrees of pollution were found during high-pressure conditions in the large Alpine valleys (Inn valles, Eisack valley, Etsch valley) where there is a lot of road traffic. Generally the concentration of pollutants was found to be higher south of the Alpine crest than north of it. During radiaton periods the southern Alpine region show a very pronounced circulation between mountains and foreland as well as between valleys and mountains capable of transporting pollutants from the forelands up to the Brenner. It also increases ozone pollution during smog episodes by forming strong inversions with powerful ozone reservoir layers above in the southern Alpine valleys. Comparison of

low-traffic and high-traffic valleys and analysis of hydrocarbon composition gave information on the impact of car traffic on the roads. In the southern Alpine region we found a positiv correlation between regional peak ozone loeads and VOC concentration, in the northern Alpine region this did practically not exist. Simulations of photochemical ozon formation show that on the days when ozone was monitored the peak ozone loads in the southern Alpine could be reduced by reducing VOC-emissions, in the northern areas this would require a reduction on NO_x-emissions. Due to the specific orographic and meteorological conditions local measures can be extremely useful. (orig./EW)

22181 (GSF–39/93, pp. 168) **Results of the POLLUMET-measuring campaigns and other research flights in the Alpine regions conducted to study air pollution.** Neininger, B. (Inst. for Atmospheric Physics ETH, EMPA-UHAG-Gebaeude, Duebendorf (Switzerland)); Dommen, J. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication AIR POLLUTION MONITORING/aircraft; POLLUTANTS/measuring methods; POLLUTANTS/environmental transport; AIR POLLUTION; AIRCRAFT; POLLUTANTS; SWITZERLAND; CLIMATES; OZONE; NITROGEN DIOXIDE; HYDROGEN PEROXIDE

22182 (GSF–39/93, pp. 169) **Air pollutant transport with special regard to chemical transformation in heavily structured areas.** Fiedler, F. (Inst. fuer Meteorologie und Klimaforschung, Kernforschungszentrum Karlsruhe/Univ. Karlsruhe (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication AIR POLLUTION/atmospheric chemistry; AIR POLLUTION MONITORING/atmospheres; POLLUTANTS/environmental transport; ATMOSPHERES; OZONE; PHOTOCHEMICAL REACTIONS; POLLUTANTS; FEDERAL REPUBLIC OF GERMANY

22183 (GSF–39/93, pp. 248-254) **The role of carry-over, climate and soil in the oak deaths in Hungary.** Berki, I. (Lehrstuhl fuer Meteorologie der Univ. Debrecen (Hungary)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Unfavourable long-term changes of the environment cause forest tree diseases due to different disease-triggering factors in many regions of Europe. Within Hungary the death quota of trees varies widely. In the Hungarian pre-Alpine region only 10% of querus petraea died whereas 30-40% of these trees died in North-Eastern Hungary. The general symptom of querus petraea in canopy thinning. Some of the sick trees dried out whitout showing nutrient deficiencies, others showed N-deficiencies. Soil are mostly parabrown soils acidified due to acid deposition buta link between soil acidification and the death of querus petraea could not be established. Deposition of N is assumed to be increased but no evidence was found in the soil or the oak leaves. We also assume that querus petraea dies less frequently in the pre-Alpine regions because the deposition of N in the pre-alpine region is higher than in NE-Hungary. The most important cause for the dying of querus petraea appears to be the two decades of drought in Hungary. Trees are weakened by water deficits and the drought also reduced microbiological mobilisation of N in the soil, some oaks are deficient in N. The querus petraea forests in the Hungarian pre-Alpine region are healthier because there is more rainfall and the frequent droughts of the last two decades occured mostly in Eastern and Northern Hungary but not in the pre-Alpine region. (orig./EW).

22184 (GSF–39/93, pp. 416-425) **The concept of the project "Leermoos/Loichtal case study" as part of the research campaing against forest death.** Gossow, H. (Univ. fuer Bodenkultur Wien, Inst. fuer Wildbiologie (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

In its second phase the research campaign against "forest death" tries to work out useful knowledge as a basis for forest restoration and conducted several case studies in different damaged forest areas in Austria. By establishing and testing diagnose profiles in the case study areas as well as developing and application of suitable expert systems we hope to find a practice-related solution for the "new" forest damages. For reasons of differential diagnostics we include existing pollution as well as acute causes of damage (eg. forest pasture, game bite etc.). We here introduce the Loisachtal (Tyrol) case study as it is fairly close to the area of the Wank-project. (orig./EW)

22185 (GSF–39/93, pp. 457-459) **Parametrisation of washout of aerosoles by means of field experiments with fluorescent-traceraerosole.** Frank, G. (GSF - Forschungszentrum fuer Umwelt und Gesundheit, Inst. fuer Strahlenschutz, Neuherberg (Germany)); Tschiersch, J. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Field studies were conducted with fluorescent traceraerosol in order to detect particale washout properties though natural precipitation. Apart from dependence on aerosole particle size we studied predominantly the influence of different raindrop size distributions in precipitations of comparable intensity. Results indicate that in weak precipitations scavenging has an important influence on the overall deposition of airborne particles. (orig./EW)

22186 (GSF–39/93, pp. 460-464) **Carry-over of plant protection agents through wet deposition on the Kleine Feldberg/Taunus.** Gath, B. (Zentrum fuer Umweltforschung der Johann Wolfgang Goethe-Universitaet, Frankfurt am Main (Germany)); Jaeschke, W.; Kubiak, R.; Ricker, I. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany).

Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

On the Feldberg and at two more sites precipitation samples were taken and analysed for selected pesticides (Lindan, Isoproturon, Triadimenol, Pirimicarb, Parathion-ethyl and atrazine). Bulk samplers (acc. to Daemmgen) were used in 14-day intervals. At two stations wet-only samplers were used in addition to the bulk samplers. Parathion-ethyl, Pirimicarb and Triadimenol were only found in single cases only. Distinct annual curves could be established for atrazin and isoproturon, they are shown in desposition charts. Only Lindan was detectable all year round. Concentrations were between 3 and 300 ng l^{-1}. Annual curves show good correlation with application periods of the individual substances. In general the annual mean value of the concentrations are below 50 ng l^{-1}. The share of dry deposition depends on substance and weather and account roughly for 10-20% of total deposition. (orig./EW)

22187 (GSF–39/93, pp. 481-485) **Effect-related air quality analyses at an Alpine location.** Jakobi, G. (Lehrstuhl fuer Bioklimatologie und Immissionsforschung, Univ. Muenchen (Germany)); Hoeppe, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Effect-related air quality measurements were carried out in Berchtesgaden-Buchenhoehe in two phases in 1992 and 1993. The photooxidants ozone and peroxiacetylnitrate were measured as well as their precursor substances NO, NO_2, in 1993 also CO and various hydrocarbons and aerosols and their acid components. These measurements are the basis for interpreting parallel lung function studies. Measuring results of June and July 1992 at this site show low mixing ratios of the precurser substances NO and NO2 and low aerosol concentrations. The proportion of acid components in aerosols, however is relatively high compared to Munich but low compared to other measuring stations, for instance in the U.S. Ozon mix is 95 ppb and shows maximum values comparable to the Munich connurbation, daily mean value are 15 to 25% higher. Apart from relatively high ozone mix ratios PAN mix ratios are an indicator of intensive formation of photooxidants. (orig./EW)

22188 (GSF–39/93, pp. 488-492) **Carry-over from clouds through riming of snow crystals. Contribution to ALPTRAC Project P1a.** Kalina, M. (Inst. fuer Analytische Chemie, TU Wien (Austria)); Puxbaum, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Riming of cloud water droplet at snow crystals plays an important role in the interaction between atmosphere and cryosphere; this plays a role in the deposition of pollutants as ion concentrations in precipitation increases with the riming of crystals and it is also important for the balancing of the cloud system and cloud water carry-over. The results of two measuring campaign at the Hoher Sonnblick (3160m, Salzburg Central Alps, Austria) form Nov 11.-18. 1991 and June 16.-19. 1992 are described. The correlation coefficient of linear regression for riming stage-concentration of pollutants for pH is -0.87, for SO_4^{2-} and NO_3^- it is 0.86/0.81; and 0.72 for riming stage /LWC. We must scrap the assumption that the increase of ion concentration in snow sample which is close to concentrations in cloudwater can be explained with strong crystal riming (snow concentration almost totally determined by rimed could water). (orig./EW)

22189 (GSF–39/93, pp. 493) **An attempt to explain the spring maximum sulphur concentrations in rainwater.** Kovar, A. (ECOSENSE, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication ATMOSPHERIC PRECIPITATIONS/ sulfates; AIR POLLUTION/sulfates; AIR POLLUTION/annual variations; SULFATES; AUSTRIA; CLIMATES

22190 (GSF–39/93, pp. 511-516) **On the development of immission and deposition of air pollutants in Southern Saxony.** Lux, H. (Technische Univ. Dresden, Fakultaet Bau, Wasser, Forst, Abt. Forstwirtschaft, Inst. fuer Pflanzenchemie und Holzchemie, Tharandt (Germany)); Wienhaus, O. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication AIR POLLUTION/sulfur dioxide; FORESTS/ sulfur dioxide; FORESTS/deposition; AIR POLLUTION MONITORING; FEDERAL REPUBLIC OF GERMANY; ANNUAL VARIATIONS; FORESTS; DEPOSITION; TERRESTRIAL ECOSYSTEMS; NITROGEN COMPOUNDS

22191 (GSF–39/93, pp. 517-520) **The deposition measuring grid in Bavaria - a comparison of total deposition and wet deposition in agriculturally used areas, pastures and forests.** Peichl, L. (Bayerisches Landesamt fuer Umweltschutz, Muenchen (Germany)); Koehler, J.; Reifenhaeuser, W.; Vierle, O. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291--: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication ATMOSPHERIC PRECIPITATIONS/air pollution; POLLUTANTS/deposition; AIR POLLUTION MONITORING;

AGRICULTURE; FORESTRY; FEDERAL REPUBLIC OF GERMANY; POLLUTANTS; DEPOSITION; PH VALUE

22192 (GSF–39/93, pp. 521) **A measuring system for the continuous determination of the filter effect of a canopy roof on aerosol particles.** Peters, K. (Univ. Bayreuth, BITOEK, Abt. Klimatologie (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication AEROSOLS/deposition; PLANTS/aerosols; PLANTS/spruces; AEROSOLS; DEPOSITION; PLANTS; SPRUCES

22193 (GSF–39/93, pp. 532-536) **Deposition of particle/bound substances during radiation fog events.** Trautner, F. (Inst. fuer Strahlenschutz, GSF-Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany)); Tschiersch, J. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

During autumnal and winterly radiation fog events size fractioned sampling of aerosol rime and fogwater was carried out. Samples were collected on polyethylene plates with a surface of 0.25 m^2. The deposited fog water quantity was as high as 15g/h.m^2. Deposition rate values were between 10^{-4} and 10^{-2} m/s. (orig./EW)

22194 (GSF–39/93, pp. 537-541) **Measuring O_3 and cosmogenic BE-7 in the Central Alps.** Vecchi, R. (Istituto di Fisica Generale Applicata, Univ. Mailand (Italy)); Valli, G.; Brambilla, E.; Barbiero, R. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Out institut runs a measuring stations of O_3 in the area of Como in the pre-Alpine region and in Valtellina at the Southern rim of the Central Alps. The aim is to study O_3-transport phenomena both vertically and on a horizontal scale. A measuring campaign was conducted which uses BE-7, cosmogenic radionucleid as a trace substance of natural O_3 and as an indicator for probable stratospheric air mass intrusions and foehn phenomena. BE-7 in the stratosphere is generated by spallation of cosmic protones on nitrogen nuclei. (orig./EW)

22195 (IC–95/82) **Analysis of atmospheric concentrations of radon and thoron using beta counting technique.** Islam, G.S. (International Centre for Theoretical Physics, Trieste (Italy)); Basunia, S.M. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 17p. Order Number DE95633238. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents a detailed theory and experimental procedure for measurement and analysis of mixed radon and thoron in the environment. The technique has been successfully applied to the study of seasonal variations of radon and thoron in Rajshahi atmosphere during the years 1989-1991. The maximum radon concentration in outdoor air was observed in the winter from December to January while the indoor radon concentration was found to be maximum during the monsoon months of July and August. The implication of results is briefly discussed in the paper. (author). 4 refs, 6 figs, 2 tabs.

22196 (JAERI-Research–95-016) **Improvement of a mesoscale atmospheric dynamic model PHYSIC. Utilization of output from synoptic numerical prediction model for initial and boundary condition.** Nagai, Haruyasu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Yamazawa, Hiromi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 27p. (In Japanese). Order Number DE95780589. Source: OSTI; NTIS; INIS.

This report describes the improvement of the mesoscale atmospheric dynamic model which is a part of the atmospheric dispersion calculation model PHYSIC. To introduce large-scale meteorological changes into the mesoscale atmospheric dynamic model, it is necessary to make the initial and boundary conditions of the model by using GPV (Grid Point Value) which is the output of the numerical weather prediction model of JMA (Japan Meteorological Agency). Therefore, the program which preprocesses the GPV data to make a input file to PHYSIC was developed and the input process and the methods of spatial and temporal interpolation were improved to correspond to the file. Moreover, the methods of calculating the cloud amount and ground surface moisture from GPV data were developed and added to the model code. As the example of calculation by the improved model, the wind field simulations of a north-west monsoon in winter and a sea breeze in summer in the Tokai area were also presented. (author).

22197 (LA–12932-MS) **Radionuclide concentrations in soils and produce from Cochiti, Jemez, Taos, and San Ildefonso Pueblo Gardens.** Fresquez, P.R.; Armstrong, D.R.; Salazar, J.G. Los Alamos National Lab., NM (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95009617. Source: OSTI; NTIS; INIS; GPO Dep.

Radionuclide (^{3}H, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu, and total uranium) concentrations were determined in soils and produce collected from Cochiti, Jemez, Taos, and San Ildefonso Pueblo gardens. All radionuclides in soils from Pueblo areas were within or just above regional statistical (natural and/or worldwide fallout) reference levels. Similarily, the average levels of radionuclides in produce collected from Cochiti, Jemez, Taos, and San Ildefonso Pueblo gardens were not significantly different in produce collected from regional (background) locations. The effective (radiation) dose equivalent from consuming 352 lb of produce from Cochiti, Jemez, Taos, and San Ildefonso, after natural background has been subtracted, was 0.036 (±0.016), 0.072 (±0.051), 0.012 (±0.027), and 0.110 (±0.102) mrem/yr, respectively. The highest calculated dose, based on the mean + 2 std dev (95% confidence level), was 0.314 mrem/yr; this was <0.4% of the International Commission on Radiological Protection permissible dose limit for protecting members of the public.

22198 (LA-UR–95-1077) **Comparison of temperature and humidity profiles with elastic-backscatter lidar data.** Soriano, C. (Universidad Politecnica de Cataluna, Barcelona (Spain)); Buttler, W.T.; Baldasano, J.M. Los Alamos National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9509120–1: Air pollution '95, Porto Cerras (Greece), 26-28 Sep 1995). Order Number DE95009496. Source: OSTI; NTIS; GPO Dep.

This contribution analyzes elastic-backscatter lidar data and temperature and humidity profiles from radiosondes acquired in Barcelona in July 1992. Elastic-backscatter lidar data reveal the distribution of aerosols within the volume of atmosphere scanned. By comparing this information with temperature and humidity profiles of the atmosphere at a similar time, we are able to asses de relationship among aerosol distribution and atmospheric stability or

water content, respectively. Comparisons have shown how lidar's revealed layers of aerosols correspond to atmospheric layers with different stability condition and water content.

22199 (LA-UR–95-1353) **An investigation of flow regimes affecting the Mexico City region.** Bossert, J.E. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9507120–3: Mountain meteorology, Breckenridge, CO (United States), 17-21 Jul 1995). Order Number DE95012062. Source: OSTI; NTIS; GPO Dep.

The Mexico City region is well-known to the meteorological community for its overwhelming air pollution problem. Several factors contribute to this predicament, namely, the 20 million people and vast amount of industry within the city. The unique geographical setting of the basin encompassing Mexico City also plays an important role. This basin covers approximately 5000 km^2 of the Mexican Plateau at an average elevation of 2250 m above sea level (asl) and is surrounded on three sides by mountains averaging over 3500 m asl, with peaks over 5000 m asl. Only to the north is their a significant opening in the mountainous terrain. Mexico City sprawls over 1000 km^2 in the southwestern portion of the basin. In recent years, several major research programs have been undertaken to investigate the air quality problem within Mexico City. One of these, the Mexico City Air Quality Research Initiative (MARI), conducted in 1990–1993, was a cooperative study between researchers at Los Alamos National Laboratory and the Mexican Petroleum Institute. As part of this study, a field campaign was initiated in February 1991 during which numerous surface, upper air, aircraft, and LIDAR measurements were taken. Much of the work to date has focused upon defining and simulating the local meteorological conditions that are important for understanding the complex photochemistry occurring within the confines of the city. It seems reasonable to postulate, however, that flow systems originating outside of the Mexico City basin will influence conditions within the city much of the time.

22200 (MISU-IMI-CM–84) **The carbon dioxide measurement program at the Department of Meteorology at Stockholm University.** Holmen, K.; Engardt, M.; Odh, S.Aa. Stockholm Univ. (Sweden). Dept. of Meteorology; International Meteorological Inst., Stockholm (Sweden). Mar 1995. 43p. Order Number DE95779295. Source: OSTI; NTIS.

The carbon dioxide measurement program at the Department of Meteorology, Stockholm University (MISU) is described in detail. The instrumentation and calibration procedures are documented. A description of the monitoring site Ny-Aalesund (78 deg 54'N, 11 deg 53'E) on Spitsbergen is presented. The quality of the monitoring data is discussed and a short presentation of results from the monitoring of CO_2 during 1989 through 1995 is given. Accuracy, precision and reliability have increased substantially during the development of the program. Accuracy is now approaching 0.1 ppm(v) decreasing from values as high as 0.5 ppm(v) during the initial stages of the monitoring effort. During 1994 there are valid data for 94% of the year. Less than 0.1% of the data in 1994 were lost due to local contamination, the remaining loss being due to technical disturbances. The Zeppelinfjellet station monitoring site (474 m above sea level) utilized since March 1990 is excellent for background monitoring of CO_2 with minimal local contamination or other disturbance. For the period January 1989 through February 1995 we observe an annual linear increase of atmospheric CO_2 of 0.67 ppm(v) and a seasonal amplitude of 16.0 ppm(v) at Ny-Aalesund. 29 refs, 9 figs, 6 tabs, 2 appendices with graphs and tables

22201 (NEI-DK–2012) **Development of small cooling systems based on the use of ammonia. Retrofitting of scale-ice machines in relation to conversion from the use of chlorofluorocarbons and hydrochlorofluorocarbons as refrigerants to the use of ammonia.** Arbejdsrapport fra Miljoestyrelsen, 5. Minds, G. (Dansk Teknologisk Institut. Energiteknologi, Taastrup (Denmark)). Miljoestyrelsen, Copenhagen (Denmark). 1995. 77p. (In Danish). Order Number DE95779224. Source: OSTI; NTIS.

A prototype scale-ice machine was developed and tested, using ammonia as a refrigerant. If all freezing machines produced at the Danish firm of 'BUUS Koeleteknik A/S' were converted to the use of ammonia as refrigerant, the reduction of chlorofluorocarbons and hydrofluorocarbons would be about 500 kg p.a. If all this firm's competitors used ammonia as refrigerant the reduction would be 2500 kg p.a., it is claimed. Results of tests showed that substituting ammonia as a refrigerant in small refrigerating plants was feasible. The necessary changes that have to be made in the interests of conversion to the use of ammonia are briefly described in addition to the dimensioning of the components of the machine. A number of photocopies of papers, calculations, letters etc. relevant to the progress of the project are included in the document. (AB)

22202 (NEI-DK–2021) **NO_x reduction by injection of natural gas above the grate, in combination with urea injection in the furnace. Introductory full-scale trial at SAYSAV's waste incineration plant in Malmoe.** Karll, B. (Danish Gas Technology Centre, Hoersholm (Denmark)); Gustafsson, P.Aa. Nordisk Gasteknisk Center, Hoersholm (Denmark). Sep 1994. 23p. Order Number DE95787783. Source: OSTI; NTIS.

Sydvaestra Skaanes Avfallsaktiobolag operates a waste-to-energy plant in Malmoe, Sweden, with two grate-fired incinerator units, incinerating 220,000 tons/year of municipal and industrial waste. In the boilers ca. 500 GWh of thermal energy is recovered, this is supplied to Malmoe's district heating network. The design of the furnace and boiler, and a flow scheme of the plant, are described. The injection of natural gas together with recirculated flue gas is located just above the grate, combined with urea injection in the furnace to reduce NO_x emission. An aim was to find operating conditions characterized by stable combustion with a reasonable level of CO emissions and a significant NO reduction. The overall aim was to establish a range of parameters for which a full-scale demonstration could be planned showing at least 75% NO_x emission reduction in relation to the baseline level of 168 mg/MJ before any measures were taken to reduce the NO_x (NO_x as NO_2 divided by input fuel heat). Efficient NO_x reduction obtained by urea injections was confirmed, but an associated ammonia slip was observed. The effect of injecting natural gas and fuel gas recirculated (FGR) alone is marginal, perhaps owing to furnace design. Combined urea and gas injection produced a strong reduction in ammonia slip compared to urea injection alone. A high urea molar ratio combined with low stoichiometry in the gas injection zone, produced 70% NO reduction. Ammonia slip and CO emissions were somewhat increased. (AB)

22203 (NEI-DK–2026) **Traffic days at AUC. Conference report vol. 1.** ISP's Skriftserie, 132. Lahrmann, H.; Hald Pedersen, L. (eds.). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. 223p. (In English, Danish, Norwegian). (CONF-9408240–Vol.1: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). Order Number DE95787784. Source: OSTI; NTIS.

The conference covered problems of sustainable transport, infrastructure, regional development and international worknets, harbors and maritime transport, urban traffic, bicycle traffic, safety and information systems. Regulation of transportation, planning, evaluation, environmental impacts of exhaust gases, cargo transport etc. were discussed in 102 presentations. (EG)

22204 (NEI-DK–2027) **Traffic days at AUC. Conference report vol. 2.** ISP's Skriftserie, 132. Lahrmann, H.; Hald Pedersen, L. (eds.). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. 282p. (In English, Danish). (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). Order Number DE95787805. Source: OSTI; NTIS.

The conference covered problems of sustainable transport, infrastructure, regional development and international worknets, harbors and maritime transport, urban traffic, bicycle traffic, safety and information systems. Regulation of transportation, planning, evaluation, environmental impacts of exhaust gases, cargo transport etc. were discussed in 102 presentations. (EG)

22205 (NEI-DK–2027, pp. 323-332) **Traffic and air pollution. Investigation of catalyst effect upon particulate emission.** Friis Hansen, K. (Dansk Teknologisk Inst., Energi/Motorteknik (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg

(Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS.

Catalysts on diesel engines of trucks, tractors and buses reduce the carbon monoxide and dioxide by 70-90%. Particulate emission effects are reduced as well. Service life of a catalyst mounted on a Danish bus is believed to be about 300,000 km. (EG)

22206 (NEI-DK–2027, pp. 341-353) **The air pollution from the traffic. Research and monitoring.** Palmgren, F. (National Environmental Research Inst., Roskilde (Denmark)); Berkowicz, R.; Hertel, O. Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS.

In the past few decades, air pollution in many European cities has changed in character. Improved technology, higher stacks and legislation limiting the sulphur contents in fuels have resulted in a marked reduction in the pollution levels of SO_2. On the other hand, due to steady growth of road traffic, the pollution from traffic has increased substantially during the same period. Emissions from traffic have become one of the most important sources of air pollution in larger European cities. Thus, studies of emissions, dispersion and chemical transformations of traffic air pollution in urban areas are becoming of increasing interest. This is felt both at the European and at the national level. At the European level, a COST action on urban air pollution has recently been initiated, aiming at coordinating research activities in the various countries. COST is a European programme for furthering collaboration within science and technology, and the programme is called COST Action 615 on Database, monitoring networks and modelling of urban air pollution. This paper will specifically address a number of Danish activities on air pollution from road traffic; several new monitoring and modelling programmes related to pollution from traffic have recently been initiated at the Danish National Environmental Research Institute (NERI). (au)

22207 (NEI-DK–2027, pp. 417-421) **Utilization of GIS data for environmental estimates.** Sand Bloch, K. (Hoff and Overgaard (Denmark)). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). (CONF-9408240–Vol.2: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Conference report vol. 2.* 282p. Order Number DE95787805. Source: OSTI; NTIS.

Use of Geographic Information Systems in environmental problems permits to map the location and distribution of city traffic and indicate the potential noise pollution modes and number of apartments affected by noise pollution. (EG)

22208 (NEI-DK–2028) **Traffic days at AUC. Supplementary report.** ISP's Skriftserie, 143. Lahrmann, H.; Hald pedersen, L. (eds.). Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. 218p. (In Danish, English). (CONF-9408240–: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). Order Number DE95787786. Source: OSTI; NTIS.

A two-volume conference report has been published in connection with the meeting 'Traffic days at the Aalborg University Centre'. The present report is a supplement to these volumes, as some contributions were not delivered before the deadline, and have been first published in full text in the supplementary report. (EG)

22209 (NEI-DK–2028, pp. 155-163) **Cold start analysis and the total national emission.** Bendtsen, H. (Vejdirektoratet, Afd. for Trafiksikkerhed og Miljoe, Forskningssektionen (Denmark)); Thorsen, H. Transportraadet, Copenhagen (Denmark); Aalborg Univ. (Denmark). Trafikforskningsgruppen. 1994. (In Danish). (CONF-9408240–: Conference on traffic days at AUC, Aalborg (Denmark), 29-30 Aug 1994). In *Traffic days at AUC. Supplementary report.* 218p. Order Number DE95787786. Source: OSTI; NTIS.

Emission from a gasoline-driven car with a cold engine is much bigger than from a preheated one, independent of catalysts. Distribution of the total emission during driving with cold and warm engine is 60% and 40% respectively. That is true, even when gasoline cars drive with a cold engine only 9% of their driving time. 34% of the total emission originates from the short trips (27% for cold engine, 7% for warm one) for cars with catalysts. (EG)

22210 (NILU-F–7/94) **Air pollution monitoring for on-line warning and alarm.** Sivertsen, B. Norsk Inst. for Luftforskning, Kjeller (Norway). Apr 1994. 7p. (CONF-9404266–1: International emergency management and engineering conference, Hollywood Beach, FL (United States), 18-21 Apr 1994). Order Number DE95779277. Source: OSTI; NTIS.

The publication deals with a concept on air pollution monitoring. The Norwegian Institute for Air Research (NILU) has been involved in the establishment of air pollution monitoring and modelling for warning and alarm systems during accidental releases and in the surroundings of industrial sites. During the oil fires in Kuwait following the 1990-91 Gulf War, NILU was asked by the World Health Organization (WHO/UNEP) to provide and install monitoring stations for an air quality information and warning system. The installation included a data network with dedicated telephone lines connected to a surveillance centre at the Environmental Protection Department in Kuwait City. Data were transferred to the centre every five minutes. On behalf of the United Nations Centre for Urgent Environmental Assistance (UNCUEA) NILU is establishing a mobile measurement platform and field laboratory for monitoring and modelling of toxic and explosive gases released after a major accident. This technology is further developed to represent part of the environmental information system (EIS) in the MEMbrain project on Major Emergency Management. The publication presents the concept including on-line meteorological measurement for modelling danger zones linked to mobile gas sensors and unmanned airborne vehicle (UAV). 9 refs., 6 figs.

22211 (NILU-F–8/94) **Environmental indicators for long-range atmospheric transported heavy metals.** Berg, T. (Norsk Inst. for Luftforskning, Kjeller (Norway)); Pedersen, U.; Steinnes, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Apr 1994. 6p. (CONF-9405323–1: Workshop on European monitoring, modelling and assessment of heavy metals and persistent organic pollutants, Beekbergen (Netherlands), 3-5 May 1994). Order Number DE95779278. Source: OSTI; NTIS.

The publication deals with environmental indicators developed for long-range transported heavy metals. The indicators are based on data for Pb and Cd from national moss surveys which are performed regularly in Norway. The interpolation programme "kriging" has been used to transform the data from irregular grids to regular grids. Contour maps have been produced, and areas above estimated background levels for Pb and Cd in mosses have been calculated. The indicators are used to characterise the atmospheric deposition of long-range atmospheric transported heavy metals and monitor the changes with time. 7 refs., 3 tabs.

22212 (NILU-OR–11/94) **Environmental indicators for atmospheric supply of long-range transported heavy metals.** Berg, T. (Norsk Inst. for Luftforskning, Kjeller (Norway)); Pedersen, U.; Steinnes, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Jan 1994. 12p. (In Norwegian). Order Number DE95779283. Source: OSTI; NTIS.

The report deals with an identification system designed for identifying the atmospheric supply of long-range transported heavy metals in Norway. The environmental indicators are based on data for lead (Pb) and cadmium (Cd) from the national investigation programme on the concentration of heavy metals in moss being executed every five years. The interpolation programme "kriging" has been used for the transmission of data from an irregular test network to a regular one. From the interpolated data set, a contour map is made together with area computing for determining the pollution level being above the chosen background level. The indicators can be used for showing the extent and changes of atmospheric precipitation of heavy metals in the terrestrial environment. 9 refs., 2 figs., 3 tabs.

22213 (NILU-OR–14/94) **Monitoring of long-range transported air pollution and precipitation. Atmospheric supply 1992.** Toerseth, K.; Joranger, E. Norsk Inst. for Luftforskning,

Kjeller (Norway). Apr 1994. 113p. (In Norwegian). Order Number DE95779274. Source: OSTI; NTIS.

The report deals with a monitoring programme for long-range air pollutants in Norway. The mean concentrations of sulphate, nitrate, ammonium and strong acid in precipitation decreased slightly from 1991 to 1992 in the counties along the southern and western coast in Southern Norway, and in Southeastern Norway the annual mean concentrations are the lowest recorded for the period 1973-1992. The mean concentrations were largely unchanged in other regions including Spitsbergen. In 1992, the annual precipitation amounts were fairly normal in Southeastern Norway, while the rest of Norway received more precipitation than normal. However, the precipitation amounts varied strongly during the year. The wet deposition of sulphate in 1992 in Southern Norway was the lowest ever measured at most stations. At the west coast, in the central and northern part of Norway the amounts deposited were not particularly low in 1992. The annual mean concentrations of sulphate and strong acid in precipitation have been decreasing since 1974. In Southern Norway these constituents were at a maximum in 1979, however. Since 1979 the content of sulphate has decreased by about 30% in Southern Norway, and by 40% in Northern Norway. 36 refs., 22 figs., 69 tabs.

22214 (NILU-OR–17/94, pp. 31-32) **3D model studies of exchange processes in the troposphere over Europe.** Flatoey, F. (Inst. of Geophysics, Univ. of Bergen, Bergen (Norway)); Hov, Oe.; Smit, H. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9403229–: Long-range transported pollutants. Supplies, effects and critical loads, Grimstad (Norway), 7-9 Mar 1994). In *Long-range transported pollutants. Supplies, effects and critical loads.* 210p. Order Number DE95779285. Source: OSTI; NTIS.

A three dimensional Mesoscale Chemistry Transport (MCT) model is driven by data from a Numerical Weather Prediction (NWP) model, over a 10 day period. The meteorological model uses cloud water as one of the prognostic variables and has an advanced treatment of stratiform and convective cloud and precipitation processes. The parameterization gives a higher resolution in time and space of cumulus cloud episodes, and improves the simulation of the convective transport and the computations of the photolysis rates which are highly dependent on cloud cover and cloud optical depth. The 10 day period, in July 1991, is characterized by warm weather and frequent occurrence of cumulus convection. The model results are compared to ground based measurements and ozone profiles. Results presented indicate that physical processes and especially convection dominates in the vertical distribution of ozone of the free troposphere, and that sinking air, compensating convective updrafts, can be an explanation of some episodes where high ozone levels are measured near ground.

22215 (NILU-OR–20/94) **Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.** Nielsen, C.J. (ed.). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. 234p. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). Order Number DE95787846. Source: OSTI; NTIS.

The report gives a collection of papers from an Nordic symposium on atmospheric chemistry. The papers comprise 31 talks and 19 short poster presentations organized in three sections covering laboratory investigations, field investigations, and theoretical investigations. A number of 21 papers are prepared. 131 refs., 47 figs., 24 tabs.

22216 (NILU-OR–20/94, pp. 9-13) **Determination of ozone isotopomer abundances by microwave- and FTIR-spectroscopy.** Christensen, L. (Lab. of Chemical Physics, Dept. of Chemistry, Univ. of Copenhagen, Copenhagen (Denmark)); Wessel Larsen, N.; Nicolaisen, F.; Pedersen, T.; Soerensen, G.O. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

Deviation from the statistical ratios (2:1) between the isotopomers in mono- and di-^{18}O substituted ozone (henceforth 50-ozone and 52- ozone) has been observed in laboratory experiments aimed at studying the mechanism of ozone formation. Similar deviations seem to occur in the stratosphere. The authors are using two methods to assess the isotopomer ratios r_{50} and r_{52}. Firstly, the microwave-spectroscopy, using a supposedly scrambled mixture of isotopomers. This method is experimentally relatively simple, but there is doubt about the extent to which the calibration mixture is actually scrambled. Secondly, the FTIR-spectroscopy, using the far-infrared, rotational bands of ozone. Although conceptually straightforward this method is fairly involved experimentally. The aim is to measure the far infrared line intensities in one or perhaps two standard mixtures, and then calibrate the microwave spectrometer using the same mixtures. 9 refs., 1 fig., 4 tabs.

22217 (NILU-OR–20/94, pp. 23-26) **Reaction of the nitrate radical with some aliphatic ethers.** Langer, S. (Dept. of Inorganic Chemistry, Univ. of Goeteborg, Goeteborg (Sweden)); Ljungstroem, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

There is little doubt about the key role of the nitrate radical in night-time tropospheric chemistry. The increasing use of ethers, especially methyl-butyl ether (MTBE), as automotive fuel additives causes increasing emissions of these compounds to the atmosphere. The paper deals with the rate coefficients for reaction between the nitrate radical and dimethyl ether, diethyl ether, di-n-propyl ether and MTBE. The rate coefficients for the reaction between nitrate radicals and the organic radicals, formed in the primary abstraction step, which is a possible secondary process, were estimated experimentally at a temperature of 295 K using both absolute and relative techniques. 3 refs., 1 tab.

22218 (NILU-OR–20/94, pp. 48-53) **Reactions of NO with a series of peroxy radicals.** Nielsen, O.J. (Chemical Reactivity Section, Environmental Science and Technology Dept., Risoe National Lab., Roskilde (Denmark)); Sehested, J.; Wallington, T.J. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The rate constants for the reaction of NO with a series of peroxy radicals were measured at 298 K and a total pressure of 1 atm. The rate constants were obtained using the absolute technique of pulse radiolysis combined with time resolved UV-VIS spectroscopy. The results are discussed in terms of reactivity trends and the atmospheric chemistry of peroxy radicals. 20 refs., 1 tab.

22219 (NILU-OR–20/94, pp. 60-64) **Laboratory studies of trace gas uptake on stratospheric aerosol mimics.** Saastad, O.W. (Dept. of Chemistry, Univ. of Oslo, Oslo (Norway)); Lund, C.E.; Ellermann, T.; Nielsen, C.J. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with ozone chemistry. A static reaction chamber attached to a mass spectrometer was employed to study the physi- and chemisorption of trace gases onto cold surfaces with varying concentrations of sulphuric acid, nitric acid and perchloric acid. Results from studies of the uptake of HCl, H Br, NO and NO_2 are presented and discussed in relation to the depletion of stratospheric ozone. 7 refs., 2 figs., 3 tabs.

22220 (NILU-OR–20/94, pp. 76-81) **Adsorption and phototransformation of PAHs on model atmospheric particles.** Tanner, H. (Inst. of Chemical Physics and Biophysics, Estonian Ac. Sci., Tallinn (Estonia)); Bogdanov, A.; Paalme, L. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with the atmospheric chemistry of polycyclic aromatic hydrocarbons (PAHs) with focus on UV-exposed aerosols. The trials focused on aerosol matrices of SiO_2, Al_2O_3 and fly ash and their relative effects on the adsorption and degradation kinetics of three PAHs: Pyrene (Pyr), Chrysene (Chr) and Benzo(a)pyrene (BaP). The degree of PAH adsorption and degradation varied significantly with the particulate matrix used. Shale-oil fly ash proved to adsorb the largest quantity of PAHs and in the least selective manner. In contrast, Al_2O_3 adsorbed the lowest quantity of PAHs and displayed the largest selectivity. The photo-oxidation rate of the PAHs studied was the largest on SiO_2, followed closely by Al_2O_3; half-lives in the range of 4 to 6 min. The half-lives for oil-shale fly ash measured in days. Variation in transformation rates between the various PAHs on any given matrix was found to be less significant than the variation seen on different matrices. Pyr was constantly the most reactive compound, followed by BaP and finally Chr, regardless of the matrix used. 1 ref., 5 figs.

22221 (NILU-OR–20/94, pp. 91-94) **NO_x, PAN, Alkyl, Nitrates, NO_y and O_3 measurements during spring in interior Alaska.** Beine, H.J. (Geophysical Inst., Univ. of Alaska, Fairbanks, AK (United States)); Jaffe, D.A.; Atlas, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

Measurements of the atmospheric concentrations of NO, NO_2, NO_y, O_3, peroxy-acetylnitrate (PAN), alkyl nitrates and hydrocarbons were made in a boreal forest ecosystem in the interior Alaska in April and May 1993. Median mixing ratios for background periods of NO_x, NOy and O_3 were 150 [ppt], 506 [ppt] and 25 [ppb], respectively. The PAN contribution to NOy was about 30%. PAN is correlated with ozone, but not with NO_x, suggesting that both, PAN and ozone were produced at a distant sources and were transported to the site. 4 refs., 6 figs., 1 tab.

22222 (NILU-OR–20/94, pp. 95-99) **Atmospheric deposition monitoring in Lithuania.** Budvytyte, D. (Inst. of Physics, Vilnius (Lithuania)); Sopauskiene, D. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

During the last decades the assessment of the atmospheric pollution load on ecosystems have been carried out in most European countries [1-5]. Atmospheric precipitation have been considered to contribute a considerable part of pollutants from the atmosphere to ecosystems. The continuous atmospheric precipitation chemistry monitoring was established in Lithuania in 1981. The main objectives of the monitoring programme were to determine the regional background air pollution and to assess pollutants load from the atmosphere to the ecosystems. Bulk collectors for precipitation were arranged at three rural sites relatively far from local anthropogenic pollution sources. These sites represent different parts of Lithuania, Preila - coastal site i W of Lithuania, Zuvintas - inland site i SW of Lithuania, and Moletai - inland forest area in E of Lithuania, and therefore, they can be treated as being representative for Lithuanian regional conditions. Monthly precipitation samples were collected and analyzed for all major ions using classical analytical chemistry methods. 8 refs., 1 fig., 3 tabs.

22223 (NILU-OR–20/94, pp. 100-103) **Heavy metals in the interaction atmosphere - earth's surface.** Ceburnis, D. (Inst. of Physics, Vilnius (Lithuania)). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with concentrations of metals in ecosystems as a function of atmospheric deposition in Lithuania. A quantitative comparison of precipitation data, moss analyses data and direct air measurements (carried out in Lithuania during 1990-1993) was made to evaluate the influence of the non atmospheric origin sources (dust from the soil surface, higher vegetation, etc.) to the content of trace metals in the moss. It was estimated that about 40% Cr content in the moss and more than 60% of Fe comes from sources other than atmospheric deposition. An average metal retention efficiency factor up to 60% in the moss was evaluated, but the variation of this factor between different elements is very significant. Deposition velocity rates for different elements range from 0.30 to 1.48 cm/s. 7 refs., 1 fig., 2 tabs.

22224 (NILU-OR–20/94, pp. 104-109) **Application of tracers in atmospheric dispersion experiments.** Ellermann, T. (National Environmental Research Inst., Dept. of Emission and Air Pollution, Roskilde (Denmark)); Lund Thomsen, E.; Lyck, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with the use of inert tracers, SF_6 and perfluorocarbons in studies of the transport and dispersion of air pollutants. The tracer is released to the atmosphere and the ground level concentrations are measured at a network of sampling units placed downwind from the release point. The aim is to examine the relationship between emission and the resulting concentration distribution for various meteorological conditions and to provide data for assessing the quality of theoretical dispersion models, SF_6 and perfluorocarbons are used as tracers due to their physical and chemical properties, - inert, nontoxic, low detection limit etc. SF_6 can be used in experiments on a range from 1 to 150 km. The perfluorocarbons (perfluoromethylcyclopentane, perfluoromethylcyclohexane, perfluorodimethylcyclohexane) can be used in experiments ranging up to thousands of km. This presentation outlines the SF_6 and perfluorocarbon tracer techniques as used at the National Environmental Research Institute. 6 refs., 3 figs.

22225 (NILU-OR–20/94, pp. 122-127) **Tropospheric nitrogen oxides in the arctic.** Jaffe, D. (Geophysical Inst. and Dept. of Chemistry, Univ. of Alaska, Fairbanks, AK (United States)). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

Nitrogen oxides play an important role in tropospheric photochemistry. NO_x is important due to its critical role in ozone production. The major end product of NO_x oxidation is HNO_3 which is a primary component of "acid precipitation". Other nitrogen oxides, such as peroxyacetyl nitrate (PAN), may provide a temporary reservoir of NO_x and therefore be important in transporting NO_x to remote regions. Since the atmospheric lifetime of NO_x is of order one day or less, most of the global atmosphere contains very low concentrations of NO_x. There is good evidence that increasing anthropogenic NO_x and hydrocarbon emissions have affected O_3 and nitric acid concentrations in remote regions of the Northern Hemisphere. Ozone data in both rural and remote regions indicate substantial increases over the last several decades (Crutzen 1988 and references therein). In the Arctic, the continuous record of surface O_3 from Barrow, Alaska shows a steady increase in concentrations of about 1.5% per year during summer. During other seasons, no statistically significant trend is present. Nitrate in the Greenland ice core also shows a substantial anthropogenic effect with concentrations approximately doubling since 1955. In the Arctic, anthropogenic pollutants are known to be present in relatively high concentration during the winter-spring period. However, as stated above, the tropospheric ozone increase is only evident during summer when other pollutants generally show a minimum. Understanding this long term increase in tropospheric ozone in the Arctic is one of the primary objectives presented. 6 refs., 3 figs.

22226 (NILU-OR–20/94, pp. 128-132) **Heavy metals in the atmosphere in Finland.** Jalkanen, L. (Finnish Meteorological Inst., Air Quality Dept., Helsinki (Finland)); Virkkula, A.; Hillamo, R.; Haesaenen, E. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third*

Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93. 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with the results from the analysis of heavy metals precipitated at seven background stations located in different parts of Finland. Atmospheric aerosol samples, divided into two fractions, were collected. The stations are susceptible to transport of air pollutants from different sources in Russia and Central Europe. Major emission sources of heavy metals in Finland, deposition from precipitation, and concentrations in atmospheric aerosols are discussed. 8 refs., 2 figs., 4 tabs.

22227 (NILU-OR–20/94, pp. 133-136) **Long range transport of atmospheric heavy metals.** Kvietkus, K. (Inst. of Physics, Vilnius (Lithuania)); Sakalys, J. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper presents the regional background levels of the atmospheric heavy metals during the long term observation. The input of the heavy metals to the Baltic sea region and Lithuania from the main prevailing wind directions is analysed and estimated. 7 refs., 2 figs.

22228 (NILU-OR–20/94, pp. 137-140) **Atmospheric mercury. Sources, speciation and deposition.** Munthe, J. (Swedish Environmental Research Inst., Goeteborg (Sweden)). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The atmosphere is important in the environmental cycling of mercury since it serves as a medium for transport from sources to remote areas. Chemical and physical transformations occur in the atmosphere leading to deposition of mercury. The rate of deposition of mercury from the atmosphere is highly dependent on the speciation. In Sweden, annual mean concentrations of total mercury and methylmercury in precipitation as well as wet deposition fluxes are higher in the south than in the north indicating an influence of the industrialized and densely populated areas of northern and central Europe. 20 refs.

22229 (NILU-OR–20/94, pp. 161-163) **Ozone loss in the Northern Hemisphere, spring 1993: Trajectory model simulations.** Floeisand, I. (Norwegian Inst. for Air Research, Kjeller (Norway)); Stordal, F. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The paper deals with a trajectory model with coupled modules representing gas phase photochemistry, microphysics and heterogeneous chemical reactions has been used for simulations of the chemistry of the stratosphere. The model has been developed through a collaboration between NILU, the University of Oslo and the Danish Meteorological Institute. The two-dimensional trajectories for the isentropic level corresponding to a potential temperature of 475 K and potential vorticity fields have been obtained from the European Centre for Medium-Range Weather Forecasts. 4 refs., 2 figs., 1 tab.

22230 (NILU-OR–20/94, pp. 164-169) **HILATAR and FINOX, 3-dimensional grid models for regional air pollutant dispersion studies.** Hongisto, M. (Finnish Meteorological Inst., Air Quality Dept., Helsinki (Finland)). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The variation of air pollutant concentrations, their exposure times and deposition are simulated at the Finnish Meteorological Institute using Eulerian type air quality models. The models are built mainly for acid deposition studies, covering nitrogen and sulphur compounds. Results of calculations made by a grid model for oxidized nitrogen compounds over Finland as well as experience with shorter time sulphur pollution with HILTAR model are discussed. 5 refs., 4 figs., 1 tab.

22231 (NILU-OR–20/94, pp. 188-191) **Impact of NO_x-emissions from aircraft on ozone chemistry.** Kraaboel, A.G. (Norwegian Inst. for Air Research, Kjeller (Norway)); Stordal, F. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The NO_x-emissions from aircraft cause a larger change in ozone compared to man-made NO_x-emissions at the surface. An ozone change near the tropopause also has a stronger impact on the radiative forcing, and thereby the climate. A trajectory model is used to study the effects of aircraft NO_x-emissions on the ozone chemistry at cruise altitude. The distribution of NO_x in the troposphere, and particularly the distribution and seasonal variations in the upper troposphere, are not well known. Due to a short atmospheric lifetime coupled with inadequate monitoring networks, the determination of long-term trends and spatial and temporal distribution is difficult. The authors were therefore particularly interested in how the impact of NO_x-emissions changed with different initial values of nitrogen in the airparcel. 4 refs., 4 figs., 2 tabs.

22232 (NILU-OR–20/94, pp. 192-196) **Chemistry and physics of aerosol dynamics in the atmosphere.** Kulmala, M. (Dept. of Physics, Univ. of Helsinki, Helsinki (Finland)). Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

Aerosol dynamics, particularly formation and growth of aerosol particles and cloud droplets are strongly dependent on atmospheric chemistry. The chemical reactions in the gas phase and in the liquid phase as well as surface reactions influence on mass fluxes. On the other hand the size, concentration and composition of aerosol particles determines the surface and volume available for surface and liquid phase chemical reactions. Wide spectrum of chemistry and physics is needed to understand air pollution. In this presentation, the author outlines the connection between atmospheric chemistry and aerosol science. 17 refs., 2 figs.

22233 (NILU-OR–20/94, pp. 206-209) **Atmospheric mercury modelling at IVL.** Pleijel, K. (Swedish Environmental Research Inst., Goeteborg (Sweden)); Munthe, J. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

A model has been developed, describing the mass transport and chemical turnover of different forms of mercury in the atmosphere. An air parcel including a fog, is simulated during 48 hours, and the influence on dissolved oxidised mercury of varying physical and chemical parameters has been studied. Calculation are carried out, using different aqueous phase chemistry schemes for different pH levels. The results show a reduction in the dissolved Hg(II) by 11 to 65% of the SO_2 concentration and emissions are doubled and an increase in dissolved Hg(II) by 20 to 130% when increasing the O_3 concentration by 40% and doubling the NO_x and VOC emissions. The total Hg(II) concentration increase by 0 to 57% when doubling the soot concentration. 10 refs., 1 fig.

22234 (NILU-OR–20/94, pp. 210-215) **Stratospheric chemistry in a 3-D global CTM.** Rummukainen, M. (FMI/Sodankylae Observatory, Sodankylae (Finland)); Isaksen, I.S.A.; Stordal, F. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

In Norway, there has been started a work on running a consistent stratospheric chemistry formulation in a global three-dimensional Chemical Transport Model (CTM). So far, the model has been used for studying tropospheric chemistry, especially at high northern latitudes. The stratospheric chemistry scheme has now been successfully incorporated into the CTM. This presentation will focus on the coupled troposphere-stratosphere formulation of the CTM, and an update on this project will be given, together with some preliminary results. 9 refs., 2 figs., 1 tab.

22235 (NILU-OR–20/94, pp. 222-227) **A two-dimensional global study of the tropospheric ozone production.** Strand, A. (Geofysisk Inst., Univ. i Bergen, Bergen (Norway)); Hov, Oe. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9312108–: NORSAC '93: 3. Nordic symposium on atmospheric chemistry, Geilo (Norway), 3-5 Dec 1993). In *Third Nordic symposium on atmospheric chemistry. Proceedings of NORSAC '93.* 234p. Order Number DE95787846. Source: OSTI; NTIS.

The ozone production in the troposphere has been studied by means of a zonally averaged model which consists of a two-dimensional transport model, a description of the emissions, wet and dry deposition and chemical processes of importance for the ozone production in the troposphere. The transport model describes a closed circulation in the meridional plane below 10 hPa, and has a resolution and a numerical solution which compares favourable with earlier 2-D studies. The transport model also takes into account the fast vertical mixing in convective clouds and in frontal circulation. The production of nitrogen oxides by lightning has been coupled to the convection parameterization by assuming that the nitrogen oxides are transported vertically in the thunder clouds and released at the altitudes where boundary layer air entrained in the convective cells is released. Comparison with observations indicate that the model is able to reproduce the seasonal variation of ozone in the meridional plane quite realistically. The calculated distributions of the chemical species which determine tropospheric ozone also compare well with measurements. A few simple experiments demonstrate the potential of the model as a tool to investigate the effect of emission reduction strategies. A 2-D model can never simulate the real atmosphere as realistic as 3-D models, but the complexity of the chemical reaction scheme combined with the possibility of cheap integrations over periods of several years, make the results from such models interesting for environmental policies. 8 refs.,

22236 (NILU-OR–23/94) **Peroxy acetyl nitrate intercalibration. Final report. Step EV4V-CT90-0222.** Krognes, T. (and others); Toupance, G.; Glavas, S. Norsk Inst. for Luftforskning, Kjeller (Norway). Jun 1994. 53p. Order Number DE95779275. Source: OSTI; NTIS.

The report deals with intercalibration of PAN (peroxy acetyl nitrate). PAN is a highly reactive and thermally unstable photo oxidant. It is formed in the atmosphere when a mixture of nitrogen oxides and organic compounds is irradiated by sunlight. It is an important reservoir for nitrogen oxides in the atmosphere. PAN interferes with many types of NO_x monitors. In large cities and industrial areas PAN is an important component of photochemical "smog". It may cause irritation of respiratory organs, and in some cases cause plant damage. One country (Italy) presently has passed legislation that includes PAN among the air quality parameters that shall be monitored in polluted areas. Good monitoring and calibration methods are required to fulfill the purpose of such legislation. The emission of nitrogen oxides (NO_x) is subjected to international treaties. To control the effect of such treaties, monitoring and modelling of NO_x components is required. PAN is not the major component, but a significant part of this picture in central European areas. In arctic areas, PAN is a major component of NO_y, and a large contributor to NO_x. 6 figs., 2 tabs.

22237 (NREL/TP–463-5784) **National Solar Radiation Data Base (1961-1990). Final technical report. Volume 2.** National Renewable Energy Lab., Golden, CO (United States). Jan 1995. 313p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95000262. Source: OSTI; NTIS; GPO Dep.

The 1961-1990 National Solar Radiation Data Base (NSRDB) for the United States was completed in September 1992. This was the final product of four years of work under the U.S. Department of Energy (DOE) Solar Radiation Resource Assessment Project. The NSRDB contains 30 years of hourly data for five solar radiation elements and 15 meteorological elements for 239 sites. The user's manual (NSRDB-Volume 1, 1992) for the NSRDB provides detailed information on the structure of the data base and the products that have been produced from it. Most users of the data base will find all of the information that they need in Volume 1. Volume 2 has been written primarily for researchers who need more information about the methods employed in producing the data base. In addition to research results, we have included information on practical lessons learned from this project. Therefore, Volume 2 should be of value to anyone developing a similar data base for other regions or other countries. Most of the solar radiation data in the NSRDB and the previous SOLMET (SOLar METeorological) data base were generated by computer models. Therefore, a major part of this report is centered around the METeorological/STATistical (METSTAT) model (Section 3.0), its input data (Sections 5.0 and 6.0), its use in producing the NSRDB (Sections 4.0 and 7.0), and comparisons with the models used in producing the SOLMET data base (Section 10.0).

22238 (ORNL/CDIAC–76) **Carbon dioxide information Analysis Center and World Data Center: A for Atmospheric trace gases. Annual progress report, FY 1994.** Burtis, M.D. (comp.) (Tennessee Univ., Knoxville, TN (United States). Energy, Environment and Resources Center); Cushman, R.M.; Boden, T.A.; Jones, S.B.; Nelson, T.R.; Stoss, F.W. Oak Ridge National Lab., TN (United States). Mar 1995. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011769. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 4352.

This report summarizes the activities and accomplishments made by the Carbon Dioxide Information Analysis Center and World Data Center-A for Atmospheric Trace Gases during the fiscal year 1994. Topics discussed in this report include; organization and staff, user services, systems, communications, Collaborative efforts with China, networking, ocean data and activities of the World Data Center-A.

22239 (ORNL/CDIAC–80) **Carbon-13 isotopic abundance and concentration of atmospheric methane for background air in the Southern and Northern Hemispheres from 1978 to 1989.** Stevens, C.M. (Argonne National Lab., IL (United States)); Sepanski; Morris, L.J. Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Mar 1995. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (NDP–049). Order Number DE95012083. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4388.

Atmospheric methane (CH_4) may become an increasingly important contributor to global warming in future years. Its atmospheric concentration has risen, doubling over the past several hundred years, and additional methane is thought to have a much greater effect on climate, on a per molecule basis, than additional $C0_2$ at present day concentrations (Shine et al. 1990). The causes of the increase of atmospheric CH_4 have been difficult to ascertain because of a lack of quantitative knowledge of the fluxes (i.e., net emissions) from the numerous anthropogenic and natural sources. The goal of CH_4 isotopic studies is to provide a constraint (and so reduce the uncertainties) in estimating the relative fluxes from the various isotopically distinct sources, whose combined fluxes must result in the measured atmospheric isotopic composition, after the fractionating effect of the atmospheric removal process is considered. In addition, knowledge of the spatial and temporal changes in the isotopic composition of atmospheric CH_4, along with estimates of the fluxes from some of the major sources, makes it possible to calculate growth rates for sources whose temporal emissions trends would be difficult to measure directly.

22240 (PNL-SA–26034) **Balloon-borne radiometer profiler: Field observations.** Shaw, W.J.; Whiteman, C.D.; Anderson, G.A.; Alzheimer, J.M.; Hubbe, J.M.; Scott, K.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503140–3: 5. atmospheric radiation

measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95011493. Source: OSTI; NTIS; INIS; GPO Dep.

This project involves the development of the capability of making routine soundings of broadband radiative fluxes and radiative flux divergences to heights of 1500m AGL. Described in this document are radiometers carried on a stabilized platform in a harness inserted in the tetherline of a tethered balloon meteriological sounding system. Field test results are given.

22241 (RISO-R–816(EN)) **TRACT database no. 4: Surface measurements. Station and data description.** Barthelmie, R.J.; Jensen, N.O. Gendan A/S, Copenhagen (Denmark). Apr 1995. 56p. Order Number DE95787744. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

The TRACT-subproject constitutes one of the main field programmes of EUROTRAC (the Eureka environmental project) 'European experiment on transport and transformation of environmentally relevant trace constituents in the troposphere over Europe'. Observations collected during the TRACT experimental campaign (conducted in September 1992) have been divided into nine databases. Database no.4 (DB no.4), which is described here, contains the surface measurements including deposition. Most of the data is meteorological although the database also contains ozone and nitrogen dioxide measurements. Considerable effort has been spent in standardising the data including supplying standard variable names and missing data codes. DB no.4 has been constructed within Paradox although it can be translated into any relational database. Following the database description is a detailed report of the data available from each of the stations which includes a station description, if one was supplied. Also given is a preliminary comparison of the data. (au) 22 tabs., 4 ills., 4 refs.

22242 (SAND–94-2586) **Preliminary evaluation of techniques for transforming regional climate model output to the potential repository site in support of Yucca Mountain future climate synthesis.** Church, H.W.; Zak, B.D.; Behl, Y.K. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013874. Source: OSTI; NTIS; INIS; GPO Dep.

The report describes a preliminary evaluation of models for transforming regional climate model output from a regional to a local scale for the Yucca Mountain area. Evaluation and analysis of both empirical and numerical modeling are discussed which is aimed at providing site-specific, climate-based information for use by interfacing activities. Two semiempirical approaches are recommended for further analysis.

22243 (SAND–95-8519C) **Raman lidar profiling of atmospheric water vapor.** Goldsmith, J.E.M.; Bisson, S.E. Sandia National Labs., Livermore, CA (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9504157–1: Combined optical-microwave earth and atmosphere conference, Atlanta, GA (United States), 3-6 Apr 1995). Order Number DE95010697. Source: OSTI; NTIS; GPO Dep.

Short communication WATER VAPOR/spatial distribution; GREENHOUSE GASES/monitoring; OPTICAL RADAR; RAMAN EFFECT; MONITORING; TROPOSPHERE; ATMOSPHERIC CIRCULATION

22244 (SAND–95-8556C) **Implementation of Raman lidar for profiling of atmospheric water vapor and aerosols at the SGP CART site.** Goldsmith, J.E.M.; Blair, F.H.; Bisson, S.E. Sandia National Labs., Livermore, CA (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9503140–6: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95011408. Source: OSTI; NTIS; GPO Dep.

Short communication. AEROSOLS/spatial distribution; WATER VAPOR/spatial distribution; GREENHOUSE GASES/monitoring; AEROSOLS; MONITORING; TROPOSPHERE; ATMOSPHERIC CIRCULATION; RAMAN EFFECT; OPTICAL RADAR

22245 (UCRL-ID–119127) **Implementation of a Rayleigh scattering optical depth parameterization.** Kemball-Cook, S.R.; Grant, K.E. Lawrence Livermore National Lab., CA (United States). Oct 1994. 4p. Sponsored by USDOE, Washington, DC (United States);Environmental Protection Agency, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013261. Source: OSTI; NTIS; GPO Dep.

A new procedure for calculating Rayleigh scattering cross sections and optical depths has been developed for use in the solar radiation transfer model of the LLNL Chemistry-Radiation-Transport Models. This procedure replaces the previous method for determining the optical depths in which the parameterization of Hansen and Travis (1974) was used to generate a table of optical depths for wavelengths ranging from 0.135 μm to 0.729 μm; the table was then placed directly in the shortwave package. Hansen and Travis calculate Rayleigh scattering optical depths, τ, using $\tau = 0.08569\lambda^{-4}(1 + 0.0113\lambda^{-2} + 0.00013\lambda^{-4})$ where λ is wavelength in μm and the standard surface pressure is 1013 mB. The new scheme uses instead the parameterization of Nicolet (1984) to find the Rayleigh scattering cross sections for an arbitrary set of wavelength bins, and from these cross sections, determines the optical depths. The Nicolet parameterization was recommended by the WMO (1986), and calculates Rayleigh scattering cross sections using $O_{RS} = 4.02 \times 10^{-28}/\lambda^{-(4 + x)}$ where $x=0.389\lambda + 0.09426/\lambda - 0.3328$ for $\lambda < 0.55$ μm and $x=0.04$ for $\lambda > 0.55$ μm.

22246 (UCRL-ID–119709) **Radiometer measurements and modeling of ultraviolet radiation at LLNL.** Wuebbles, D.J. (Lawrence Livermore National Lab., CA (United States)); Patten, K.O. Jr.; Grossman, A.S. Lawrence Livermore National Lab., CA (United States). Jan 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011442. Source: OSTI; NTIS; GPO Dep.

A program at the LLNL for the measurement and monitoring of ultraviolet radiation is briefly described, with an emphasis on seasonal variations, and aerosol effects.

22247 (UCRL-JC–117424) **LLNL and TRW extend benchmark environmental stress testing for two alternative printed board cleaners.** Hersey, R.J. Jr. (Lawrence Livermore National Lab., CA (United States)); Meltzer, M.; Hofstad, H.W.; Lawrence, M.; Sanborn, R.; Arauco, H. Lawrence Livermore National Lab., CA (United States). Mar 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506182–1: NEPCON East '95, Boston, MA (United States), 12-15 Jun 1995). Order Number DE95011718. Source: OSTI; NTIS; GPO Dep.

TRW Corporation and LLNL jointly conducted a testing program to evaluate the effectiveness of non-CFC defluxing chemistries on printed boards designed for high reliability military and aerospace applications. TRW assessed existing data for alternative chemistries, selected candidates for further testing, implemented the cleaning processes, and performed ionic conductivity testing on the spent solvents. LLNL designed and fabricated special circuit boards with interdigitated comb patterns to allow insulation resistance (IR) measurements under selected soldered components. LLNL designed the test and measurement setup and conducted accelerated environmental stress testing of flux residues for 28 days following cleaning. Statistical analyses of the IR measurements were correlated with visual observations and spectroscopic (FTIR) measurements. Performance of the alternative chemistries was compared with that of a standard CFC cleaning agent also included in the test program. The program was designed to follow the same environmental stress and electrical measurement requirements as the IPC/DOD/EPA Ad Hoc Solvent Working Group's benchmark 7-day test plan, but with certain minor modifications and extension to 28 days.

22248 (UCRL-JC–117494) **Atmospheric model intercomparison project: Monsoon simulations.** Sperber, K.R. (Lawrence Livermore National Lab., CA (United States). Program for Climate Model Diagnosis and Intercomparison); Palmer, T.N. Lawrence Livermore National Lab., CA (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9405322–1: International conference on

monsoon variability and prediction, Trieste (Italy), 9-13 May 1994). Order Number DE95012223. Source: OSTI; NTIS; GPO Dep.

The simulation of monsoons, in particular the Indian summer monsoon, has proven to be a critical test of a general circulation model's ability to simulate tropical climate and variability. The Monsoon Numerical Experimentation Group has begun to address questions regarding the predictability of monsoon extremes, in particular conditions associated with El Nino and La Nina conditions that tend to be associated with drought and flood conditions over the Indian subcontinent, through a series of seasonal integrations using analyzed initial conditions from successive days in 1987 and 1988. In this paper the authors present an analysis of simulations associated with the Atmospheric Model Intercomparison Project (AMIP), a coordinated effort to simulate the 1979–1988 decade using standardized boundary conditions with approximately 30 atmospheric general circulation models. The 13 models analyzed to date are listed. Using monthly mean data from these simulations they have calculated indices of precipitation and wind shear in an effort to access the performance of the models over the course of the AMIP decade.

22249 (UCRL-JC–118287) **Target induced, turbulence-modulated speckle noise.** Scharlemann, E.T. Lawrence Livermore National Lab., CA (United States). Jul 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404162–22: 1994 chemical analysis by laser interrogation of proliferation effluents (CALIOPE ITR) interim technical review, Livermore, CA (United States), 26-28 Apr 1994). Order Number DE95014202. Source: OSTI; NTIS; GPO Dep.

Many papers on DIAL for remote sensing have been devoted to the averaging properties of speckle noise from diffuse-target returns; i.e., how many (N) return pulses can be averaged before the I/N reduction in signal variance expected from uncorrelated noise fails. An apparent limit of about 100 pulses or fewer has been the most important factor in determining the accuracy of DIAL measurements using diffusely-scattering targets in the field. The relevant literature is briefly reviewed, and various explanations for the apparent limit are summarized. Recent speckle experiments at LLNL's Site 300 may suggest that the limit of ~100 pulses is not fundamental. The speckle experiments very clearly show that the limit on signal averaging in this data was the result of long-term (~1 minute) drifts in the signal returns rather than of any more subtle statistical properties. The long-term drifts are completely removed to the useful limits of the data sets by working with the log-ratio of adjacent pulses. This procedure is analogous (but not identical) to processing the log-ratios of the powers at different wavelengths in a multi-line DIAL system. We think the Site 300 data therefore suggests that as long as the laser system is constructed to ensure that any long-term drifts are identical among the transmitted wavelengths, the log-ratio of the individual returns will provide a data set that does usefully average over a large number of pulses.

22250 (UCRL-JC–118707) **Multi-angle technique for measurement of ground source emission.** Henderson, J.R. Lawrence Livermore National Lab., CA (United States). Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–7: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95011722. Source: OSTI; NTIS; GPO Dep.

TAISIR, the Temperature and Imaging System Infrared, is a nominally satellite based platform for remote sensing of the earth. One of its design features is to acquire atmospheric data simultaneous with ground data, resulting in minimal dependence on external atmospheric models for data correction. One technique we employ to acquire atmospheric data is a true multi-angle data acquisition technique. Previous techniques have used only two angles. Here we demonstrate the advantage of using a large number of viewing angles to overconstrain the inversion problem for critical atmospheric and source parameters. For reasonable data acquisition scenarios, simulations show source temperature errors of less than 1K should be possible. Tradeoffs between flight geometry, number of look angles,, and system signal-to-noise are given for typical parameter ranges.

22251 (UCRL-JC–119134) **ARAC participation in the European tracer experiment.** Pace, J.C. (EG and G Energy Measurements, Inc., Pleasanton, CA (United States)); Pobanz, B.M.; Foster, C.S. Lawrence Livermore National Lab., CA (United States); EG and G Energy Measurements, Inc., Pleasanton, CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; AC08-93NV11265. (CONF-950430–5: 5. ANS topical meeting on emergency preparedness and response, Savannah, GA (United States), 18-21 Apr 1995). Order Number DE95012483. Source: OSTI; NTIS; GPO Dep.

This paper describes participation by the Lawrence Livermore National Laboratory's Atmospheric Release Advisory Capability (ARAC) in the 1994 European Tracer Experiment (ETEX). ARAC is a real-time emergency-response center, operating a suite of numerical models which simulate the advection and diffusion of airborne releases, and which calculate estimates of the downwind concentration of the released material. The ETEX scenario involved actual releases of inert tracer gases into the atmosphere, with detection by samplers at many locations across Europe, allowing subsequent comparison between detected values and the values predicted at each sampler location by the exercise participants. To prepare for ETEX, ARAC made only minor changes to its operational models, primarily related to the large area covered by the plume. The ARAC response to ETEX was similar to that for a release at any non-supported location. Results based on various externally-supplied wind fields will be discussed.

22252 (USGS-OFR–94-569) **Volcanic gas emissions and their impact on ambient air character at Kilauea Volcano, Hawaii.** Sutton, A.J. (Minerals Management Service, Menlo Park, CA (United States)); Elias, T.; Navarrete, R. Minerals Management Service, Menlo Park, CA (United States); Geological Survey, Hawaii National Park, HI (United States). Hawaiian Volcano Observatory. [1994]. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22089. Order Number DE95013087. Source: OSTI; NTIS; GPO Dep.

Gas emissions from Kilauea occur from the summit caldera, along the middle East Rift Zone (ERZ), and where lava enters the ocean. We estimate that the current ERZ eruption of Kilauea releases between 400 metric tonnes of SO_2 per day, during eruptive pauses, to as much as 1850 metric tonnes per day during actively erupting periods, along with lesser amounts of other chemically and radiatively active species including H_2S, HCl and HF. In order to characterize gas emissions from Kilauea in a meaningful way for assessing environmental impact, we made a series of replicate grab-sample measurements of ambient air and precipitation at the summit of Kilauea, along its ERZ, and at coastal sites where lava enters the ocean. The grab-sampling data combined with SO_2 emission rates, and continuous air quality and meteorological monitoring at the summit of Kilauea show that the effects of these emissions on ambient air character are a complex function of chemical reactivity, source geometry and effusivity, and local meteorology. Prevailing tradewinds typically carry the gases and aerosols released to the southwest, where they are further distributed by the regional wind regime. Episodes of kona, or low speed variable winds sometimes disrupt this pattern, however, and allow the gases and their oxidation products to collect at the summit and eastern side of the island. Summit solfatara areas of Kilauea are distinguished by moderate to high ambient SO_2, high H_2S at one location, and low H_2S at all others, and negligible HCl concentrations, as measured 1 m from degassing point-sources. Summit solfatara rain water has high sulfate and low chloride ion concentrations, and low pH.

22253 (WHC-SD-GN-SWD–30002-Rev.1) **GXQ program user's guide. Revision 1.** Hey, B.E. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012583. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the program user's guide of a general purpose atmospheric dispersion code named GXQ. GXQ is an IBM Compatible microcomputer based program for calculating atmospheric dispersion coefficients using Hanford site specific joint

frequency data. It uses the Gaussian straight line model to calculate either an atmospheric dispersion coefficient (X/Q′) or a maximum normalized air concentration (X/Q). Several options are available to the user which alter the standard Gaussian model to allow for plume depletion, building wake, plume meander, sector averaging, gravitational settling and plume rise. Additional options control handling of the joint frequency data and output. Combinations of the above allow calculation of X/Q′ in accordance with Nuclear Regulatory Commission Regulatory Guide 1.145.

22254 (WHC-SD-W059-DR–001) **Engineer/Constructor Management Plan B-Plant Canyon Ventilation Upgrade Project W-059.** Condron, J.D. ICF Kaiser Hanford Co., Richland, WA (United States). 27 Apr 1995. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011545. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the conceptual design for Project W-059, B Plant Canyon Ventilation Upgrade.

22255 (WHC-SD-WM-TI–700) **296-B-13 stack monitoring and sampling system: Annual system assessment report.** Ridge, T.M. Westinghouse Hanford Co., Richland, WA (United States). 16 May 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012825. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the annual system assessment of the air pollution monitoring and sampling system for the 296-13 stack at the Hanford site. Topics discussed include; system description, system status, system aging, spare parts considerations, long term maintenance plan, trends, and items requiring action.

22256 (WSRC-TR–94-0616) **H-Area, K-Area, and Par Pond Sewage Sludge Application Sites Groundwater Monitoring Report. Fourth quarter 1994 and 1994 summary.** Chase, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). Apr 1995. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060134. Source: OSTI; NTIS; GPO Dep.

Groundwater samples from the three wells at the H-Area Sewage Sludge Application Site (HSS wells) are analyzed quarterly for constituents as required by South Carolina Department of Health and Environmental Control Construction Permit 12,076. Samples from the three wells at the K-Area Sewage Sludge Application Site (KSS wells) and the three wells at the Par Pond Sewage Sludge Application Site (PSS wells) are analyzed quarterly for constituents required by SCDHEC Construction Permit 13,173. All samples are also analyzed as requested for other constituents as part of the Savannah River Site Groundwater Monitoring Program. Annual analyses for other constituents, primarily metals. also are required by the permits.

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Refer also to citation(s) 20750, 20758, 20765, 20774, 20777, 20796, 20806, 20812, 20821, 20843, 20848, 20964, 20979, 20992, 20993, 20995, 21000, 21004, 21021, 21022, 21026, 21241, 21242, 21346, 21351, 21397, 21659, 21666, 21755, 21812, 22106, 22146, 22149, 22172, 22173, 22174, 22175, 22177, 22183, 22184, 22185, 22186, 22189, 22190, 22238, 22241, 22344, 22346, 22348, 22465, 22471, 22474, 22476, 22481, 22498, 22505, 22977

22257 (ANL–94/41) **Analytical electron microscopy characterization of Fernald soils. Annual report, October 1993–September 1994.** Buck, E.C.; Brown, N.R.; Dietz, N.L. Argonne National Lab., IL (United States). Mar 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95010856. Source: OSTI; NTIS; INIS; GPO Dep.

A combination of backscattered electron imaging and analytical electron microscopy (AEM) with electron diffraction have been used to determine the physical and chemical properties of uranium contamination in soils from the Fernald Environmental Management Project in Ohio. The information gained from these studies has been used in the development and testing of remediation technologies. Most chemical washing techniques have been reasonably effective with uranyl [U(VI)] phases, but U(IV) phases have proven difficult to remove from the soils. Carbonate leaching in an oxygen environment (heap leaching) has removed some of the U(IV) phases, and it appears to be the most effective technique developed in the program. The uranium metaphosphate, which was found exclusively at an incinerator site, has not been removed by any of the chemical methods. We suggest that a physical extraction procedure (either a magnetic separation or aqueous biphasic process) be used to remove this phase. Analytical electron microscopy has also been used to determine the effect of the chemical agents on the uranium phases. It has also been used to examine soils from the Portsmouth site in Ohio. The contamination there took the form of uranium oxide and uranium calcium oxide phases. Technology transfer efforts over FY 1994 have led to industry-sponsored projects involving soil characterization.

22258 (ANL/EAD/TM–38-Vol.2) **Remedial investigation sampling and analysis plan for J-Field, Aberdeen Proving Ground, Maryland: Volume 2, Quality Assurance Project Plan.** Prasad, S.; Martino, L.; Patton, T. Argonne National Lab., IL (United States). Mar 1995. 173p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95011690. Source: OSTI; NTIS; GPO Dep.

J-Field encompasses about 460 acres at the southern end of the Gunpowder Neck Peninsula in the Edgewood Area of APG (Figure 2.1). Since World War II, the Edgewood Area of APG has been used to develop, manufacture, test, and destroy chemical agents and munitions. These materials were destroyed at J-Field by open burning and open detonation (OB/OD). For the purposes of this project, J-Field has been divided into eight geographic areas or facilities that are designated as areas of concern (AOCs): the Toxic Burning Pits (TBP), the White Phosphorus Burning Pits (WPP), the Riot Control Burning Pit (RCP), the Robins Point Demolition Ground (RPDG), the Robins Point Tower Site (RPTS), the South Beach Demolition Ground (SBDG), the South Beach Trench (SBT), and the Prototype Building (PB). The scope of this project is to conduct a remedial investigation/feasibility study (RI/FS) and ecological risk assessment to evaluate the impacts of past disposal activities at the J-Field site. Sampling for the RI will be carried out in three stages (I, II, and III) as detailed in the FSP. A phased approach will be used for the J-Field ecological risk assessment (ERA).

22259 (ANL/EAD/TM–40) **Remedial Investigation Work Plan for J-Field, Aberdeen Proving Ground, Maryland.** Benioff, P.; Biang, R.; Dolak, D.; Dunn, C.; Haffenden, R.; Martino, L.; Patton, T.; Wang, Y.; Yuen, C. Argonne National Lab., IL (United States). Mar 1995. 209p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95011691. Source: OSTI; NTIS; GPO Dep.

The purpose of an RI/FS is to characterize the nature and extent of the risks posed by contaminants present at a site and to develop and evaluate options for remedial actions. The overall objective of the RI is to provide a comprehensive evaluation of site conditions, types and quantities of contaminants present, release mechanisms and migration pathways, target populations, and risks to human health and the environment. The information developed during the RI provides the basis for the design and implementation of remedial actions during the FS. The purpose of this RI Work Plan is to define the tasks that will direct the remedial investigation of the J-Field site at APG.

22260 (ANL/ER/CP–86429) **Integration of geophysics within the Argonne expedited site characterization Program at a site in the southern High Plains.** Hastings, B.; Hildebrandt, G.; Meyer, T.; Saunders, W.; Burton, J.C. Argonne National Lab., IL (United States). [1995]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950450–8: 8. annual symposium on the application of geophysics to environmental and engineering problems, Orlando, FL (United States), 23-27 Apr 1995). Order Number DE95011792. Source: OSTI; NTIS; GPO Dep.

An Argonne National Laboratory Expedited Site Characterization (ESC) program was carried out at a site in the central United States. The Argonne ESC process emphasizes an interdisciplinary approach in which all available information is integrated to produce as complete a picture as possible of the geologic and hydrologic controls on contaminant distribution and transport. As part of this

process, all pertinent data that have been collected from previous investigations are thoroughly analyzed before a decision is made to collect additional information. A seismic reflection program recently concluded at the site had produced inconclusive results. Before we decided whether another acquisition program was warranted, we examined the existing data set to evaluate the quality of the raw data, the appropriateness of the processing sequence, and the integrity of the interpretation. We decided that the field data were of sufficient quality to warrant reprocessing and reinterpretation. The main thrust of the reprocessing effort was to enhance the continuity of a shallow, low-frequency reflection identified as a perching horizon within the Ogallala formation. The reinterpreted seismic data were used to locate the boundaries of the perched aquifer, which helped to guide the Argonne ESC drilling and sampling program. In addition, digitized geophysical well log data from previous drilling programs were reinterpreted and integrated into the geologic and hydrogeologic model.

22261 (ANL/ES/CP–85635) **Bench- and pilot-scale thermal desorption treatability studies on pesticide-contaminated soils from Rocky Mountain Arsenal.** Swanstrom, C.P. (Argonne National Lab., IL (United States)); Besmer, M. Argonne National Lab., IL (United States). 9 Mar 1995. 19p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503161–1: 7. annual Gulf Coast environmental conference, Houston, TX (United States), 9 Mar 1995). Order Number DE95012267. Source: OSTI; NTIS; GPO Dep.

Thermal desorption is being considered as a potential remediation technology for pesticide-contaminated soils at the Rocky Mountain Arsenal (RMA) in Denver, Colorado. From 1988 through 1992, numerous laboratory- and bench-scale indirect-heated thermal desorption (IHTD) treatability studies have been performed on various soil medium groups from the arsenal. RMA has contracted Argonne National Laboratory to conduct a pilot-scale direct-fired thermal desorption (DFTD) treatability study on pesticide-contaminated RMA soil. The purpose of this treatability study is to evaluate the overall effectiveness of the DFTD technology on contaminated RMA soils and to provide data upon which future conceptual design assumptions and cost estimates for a full-scale system can be made. The equipment used in the DFTD treatability study is of large enough scale to provide good full-scale design parameters and operating conditions. The study will also provide valuable-emissions and materials-handling data. Specifically this program will determine if DFTD can achieve reductions in soil contamination below the RMA preliminary remediation goals (PRGs), define system operating conditions for achieving the PRGs, and determine the fate of arsenic and other hazardous metals at these operating conditions. This paper intends to compare existing data from a bench-scale IHTD treatability study using equipment operated in the batch mode to new data from a pilot-scale DFTD operated in a parallel-flow continuous mode. Delays due to materials-handling problems and permit issues have delayed the start of the pilot-scale DFTD testing. The first pilot-scale test is scheduled for the flat week in January 1995. The available data will be presented March 9, 1995, at the Seventh Annual Gulf Coast Environmental Conference in Houston, Texas.

22262 (CDTN-DERL-CN–020/88) **IN SITU density measurements oozy bottom of the access channel to the port of Santos, Sao Paulo, Brazil.** Minardi, P.S.P. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). Div. de Engenharia Ambiental. Sep 1988. 24p. (In Portuguese). Order Number DE95632468. Source: OSTI; NTIS (US Sales Only); INIS.

The density of the bottom sediment of the access channel to the port of Santos, Sao Paulo, Brazil was measured. The in situ measurements aimed at verifying the use for navigation purposes of the layers with densities equal to or smaller than 1200 kg/m^3. (F.E.). 3 refs, 55 figs, 3 tabs.

22263 (CONF-9406337–Absts.) **AGU Chapman Conference Hydrogeologic Processes: Building and Testing Atomistic- to Basin-Scale Models.** Weaver, B. (American Geophysical Union, Washington, DC (United States)). American Geophysical Union, Washington, DC (United States); USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). [1994]. 27p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). From AGU Chapman conference on hydrogeologic processes: Building and testing atomistic- to basin-scale models; Lincoln, NH (United States); 6-9 Jun 1994. Order Number DE95013091. Source: OSTI; NTIS; GPO Dep.

This report presents details of the Chapman Conference given on June 6–9, 1994 in Lincoln, New Hampshire. This conference covered the scale of processes involved in coupled hydrogeologic mass transport and a concept of modeling and testing from the atomistic- to the basin- scale. Other topics include; the testing of fundamental atomic level parameterizations in the laboratory and field studies of fluid flow and mass transport and the next generation of hydrogeologic models. Individual papers from this conference are processed separately for the database.

22264 (CONF-9509121–1) **Potentially disruptive hydrologic features, events and processes at the Yucca Mountain Site, Nevada.** Hoxie, D.T. Geological Survey, Las Vegas, NV (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. From Characterizations of long term geological changes being considered for disposal sites; Paris (France); 19-21 Sep 1995. Order Number DE95009558. Source: OSTI; NTIS; INIS; GPO Dep.

Yucca Mountain, Nevada, has been selected by the United States to be evaluated as a potential site for the development of a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. If the site is determined to be suitable for repository development and construction is authorized, the repository at the Yucca Mountain site is planned to be constructed in unsaturated tuff at a depth of about 250 meters below land surface and at a distance of about 250 meters above the water table. The intent of locating a repository in a thick unsaturated-zone geohydrologic setting, such as occurs at Yucca Mountain under the arid to semi-arid climatic conditions that currently prevail in the region, is to provide a natural setting for the repository system in which little ground water will be available to contact emplaced waste or to transport radioactive material from the repository to the biosphere. In principle, an unsaturated-zone repository will be vulnerable to water entry from both above and below. Consequently, a major effort within the site-characterization program at the Yucca Mountain site is concerned with identifying and evaluating those features, events, and processes, such as increased net infiltration or water-table rise, whose presence or future occurrence could introduce water into a potential repository at the site in quantities sufficient to compromise the waste-isolation capability of the repository system.

22265 (DMI-TR–95-5) **Forecasting ozone concentrations. Initial testing of model setup.** Svensmark, H. Danish Meteorological Inst., Copenhagen (Denmark). 1995. 29p. Order Number DE95787775. Source: OSTI; NTIS.

The report deals with current efforts at the Danish Meteorological Institute (DMI) to be able to calculate and predict concentrations levels of pollution in the troposphere, in particular to calculate ozone concentrations. A version of the EMEP-chemistry-model (European Monitoring and Evaluation Programme) has been implemented at the DMI-convex. The model optimized to include a program made to read the EMEP-emissions, and another to read the volatile organic compounds emissions from forests, annual/daily variations of sun declination and the use of meteorological data. The Trajectory-program at DMI provides input data to the Chemistry program. These data are: one or more trajectories to one or more locations, the height of the atmospheric boundary layer, the temperature at surface, the temperature in the mixing layer, precipitation and relative humidity. Typical values of the above parameters are used. Unlike previous use of the EMEP-model the height of the atmospheric boundary layer is not based on observations (historical data), but has to be predicted. Efforts have been made to determine the most accurate method. One version of the program lies on the disperse account on the convex computer. The full program (trajectory and chemistry) makes automatically two forecasts every 24 hours. The ozone concentrations calculated can be compared with the measured concentrations at Jaegersborg. The 'first generation' of the program has been tested against these measurements, with an expected poor performance.

Presently a 'new' version of the EMEP model is being developed where all the meteorological parameters are incorporated, and a full test of the programme against ozone data measured by the National Environmental Research Institute (DMU). (AB)

22266 (DOE/EA–1013) **The proposed Diagnostic Instrumentation and Analysis Laboratory, Mississippi State University.** Calscience Research Inst., Huntington Beach, CA (United States). Nov 1994. 30p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012237. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) proposes to authorize Mississippi State University (MSU) to proceed with the detailed design, construction and equipping of the proposed Diagnostic Instrumentation and Analysis Laboratory (DIAL). DOE grant funds are available to the University for the limited purpose of performing preliminary studies, including analysis necessary to conduct this environmental assessment. The proposed facility would be located in the Mississippi Research and Technology Park, adjacent to the Mississippi Agriculture and Forestry Experiment Station campus in Starkville, Mississippi. Total project cost is estimated at $7,953,600. This proposed laboratory would be designed to conduct research into combustion devices related to waste management and environmental restoration that is of importance to industry and government. The proposed facility's role would be to develop diagnostic instrumentation capabilities in the area of combustion and related processes.

22267 (DOE/EA–1023) **Willow Creek Wildlife Mitigation Project. Final environmental assessment.** USDOE Bonneville Power Administration, Portland, OR (United States). Apr 1995. 138p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012132. Source: OSTI; NTIS; INIS; GPO Dep.

Today's notice announces BPA's proposal to fund land acquisition or acquisition of a conservation easement and a wildlife management plan to protect and enhance wildlife habitat at the Willow Creek Natural Area in Eugene, Oregon. This action would provide partial mitigation for wildlife and wildlife habitat lost by the development of Federal hydroelectric projects in the Willamette River Basin. The project is consistent with BPA's obligations under provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 as outlined by the Northwest Power Planning Council's 1994 Columbia River Basin Fish and Wildlife Program. BPA has prepared an environmental assessment (DOE/EA-1023) evaluating the proposed project. Based on the analysis in the EA, BPA has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement (EIS) is not required and BPA is issuing this FONSI.

22268 (DOE/EA–1055) **Proposed center for advanced industrial processes. Washington State University, College of Engineering and Architecture.** Department of Energy, Washington, DC (United States). Div. of Electric Energy Systems. Mar 1995. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012960. Source: OSTI; NTIS; GPO Dep.

The DOE proposes to authorize Washington State University (WSU) to proceed with the detailed design, construction, and equipping of the proposed Center for Advanced Industrial Processes (CAIP). The proposed project would involve construction of a three story building containing laboratories, classrooms, seminar rooms, and graduate student and administrative office space. Existing buildings would be demolished. The proposed facility would house research in thermal/fluid sciences, bioengineering, manufacturing processes, and materials processing. Under the "no-action" DOE would not authorize WSU to proceed with construction under the grant. WSU would then need to consider alternatives for proceeding without DOE funds. Such alternatives (including delaying or scaling back the project), would result in a postponement or slight reduction in the minor adverse environmental, safety and health Impacts of the project evaluated in this assessment. More importantly, these alternatives would affect the important environmental, safety, health, and programmatic benefits of the projects. The surrounding area is fully urbanized and the campus is intensely developed around the proposed site. The buildings scheduled for demolition do not meet State energy codes, are not air conditioned, and lack handicapped access. Sensitive resources (historical/archeological, protected species/critical habitats, wetlands/floodplains, national forests/parks/trails, prime farmland and special sources of water) would not be affected as they do not occur on or near the proposed site. Cumulative impacts would be small. The proposed action is not related to other actions being considered under other NEPA reviews. There is no conflict between the proposed action and any applicable Federal, State, regional or local land use plans and policies.

22269 (DOE/EA–1090) **Disbursement of $65 million to the State of Texas for construction of a Regional Medical Technology Center at the former Superconducting Super Collider Site, Waxahachie, Texas.** USDOE Oak Ridge Operations Office, TN (United States). May 1995. 76p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012964. Source: OSTI; NTIS; INIS; GPO Dep.

As part of a settlement agreement between the US DOE and the State of Texas, DOE proposes to transfer $65 million of federal funds to the Texas National Research Laboratory Commission (TNLRC) for construction of the Regional Medical Technology Center (RMTC) to be located in Ellis County, Texas. The RMTC would be a state-of-the-art medical facility for proton cancer therapy, operated by the State of Texas in conjunction with the University of Texas Southwestern Medical Center. The RMTC would use the linear accelerator assets of the recently terminated DOE Superconducting Super Collider Project to accelerate protons to high energies for the treatment of cancer patients. The current design provides for treatment areas, examination rooms, support laboratories, diagnostic imaging equipment, and office space as well as the accelerators (linac and synchrotron) and beam steering and shaping components. The potential environmental consequences of the proposed action are expected to be minor.

22270 (DOE/EM–0233) **The Formerly Utilized Sites Remedial Action Program (FUSRAP): Building stakeholder partnerships to achieve effective cleanup.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Office of Environmental Restoration. Apr 1995. 36p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95010337. Source: OSTI; NTIS; INIS; GPO Dep.

This booklet describes the U.S. Department of Energy's (DOE's) Formerly Utilized Sites Remedial Action Program (FUSRAP). This document describes the history of the FUSRAP program and discusses the ongoing and planned efforts to remediate FUSRAP sites. The U.S. DOE created FUSRAP in 1974 to identify, investigate, and clean up or control sites where contamination above today's guidelines remains from the early years of the nation's atomic energy programs.

22271 (DOE/MC–29103-95/C0459) **Lightguide-coupled sensor for in-situ radiation monitoring.** Reed, S.E.; Berthold, J.W. Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div. [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29103. (CONF-9506183–1: Optics for environmental and public safety, Munich Bavaria (Germany), 19-23 Jun 1995). Order Number DE95012313. Source: OSTI; NTIS; INIS; GPO Dep.

The authors are developing a multi-point radiation monitoring system for long-term, continuous monitoring of radiation levels in the vadose zone of radioactive waste sites. The system is based on gamma detection with a lightguide-coupled scintillator built into a probe buried in the ground. The lightguide transmits the visible light pulses produced by the scintillator to the surface where detection and signal multiplexing take place. The system is to be capable of monitoring large numbers of such passive probes which are to be permanently installed throughout the waste site. The authors have recently completed tests of a prototype single-probe system. In this paper, they report on the development and testing of the single-probe system.

22272 (DOE/RL–94-36-4) **Quarterly report of RCRA groundwater monitoring data for period October 1 through December**

31, 1994. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 429p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012821. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA); and "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" (Title 40 Code of Federal Regulations [CFR] Part 265), as amended. Compliance with the 40 CFR 265 regulations is required by the Washington Administrative Code (WAC) 173-303. This report contains data from Hanford Site groundwater monitoring projects. The location of each facility is shown. Westinghouse Hanford Company (WHC) manages the RCRA groundwater monitoring projects for federal facilities on the Hanford Site. Performing project management, preparing groundwater monitoring plans, well network design and installation, specifying groundwater data needs, performing quality control (QC) oversight, data management, and preparing project sampling schedules are all parts of this responsibility. Pacific Northwest Laboratory (PNL) administers the contract for analytical services and provides groundwater sampling services to WHC for the RCRA groundwater monitoring program. This quarterly report contains data received between October and December 1994, which are the cutoff dates for this reporting period. This report may contain not only data from the October through December quarter, but also data from earlier sampling events that were not previously reported.

22273 (DOE/SR/15160–6-Vol.1) **Hydrogeologic investigation and establishment of a permanent multi-observational well network in Aiken, Allendale, and Barnwell Counties, South Carolina. Eight-year interim report (1986-1994). Volume 1 cluster-site description.** Gellici, J.A.; Reed, R.H.; Logan, W.R.; Aadland, R.K.; Simones, G.C. South Carolina Dept. of Natural Resources, Columbia, SC (United States). May 1995. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC09-86SR15160. Order Number DE95012406. Source: OSTI; NTIS; GPO Dep.

The South Carolina Department of Natural Resources, Water Resources Division (SCWRD), in collaboration with the United States Department of Energy (USDOE) is conducting a hydrogeologic investigation of the ground-water system(s) peripheral to the Savannah River Site. The study area is located in the Southeastern Coastal Plain hydrogeologic province in Aiken, Allendale and Barnwell Counties, South Carolina. Ground-water movement, quality, and availability are being evaluated in order to better protect and manage this valuable regional resource. The investigation involves a well-cluster system comparable to the one constructed on the SRS. Cluster sites are situated outside the SRS on the basis of study objectives, proximity to the plant's borders, land availability, and for the optimization of hydrogeologic control. One to three wells are completed into each major aquifer, and at each cluster site, at least one borehole is continuously cored and geophysically logged from land surface to at least 10 feet into unweathered bedrock. Data collected from the ongoing study include 146 paleontologic and palynologic age dates, 100 x-ray diffraction analyses of clay and bulk mineralogy, 442 sieve analyses, 6,040 feet of detailed core description, mineral composition and porosity determined from thin-section analyses, and continuous water-level data. This report is a compilation and interpretation of the "C-well" data that have been generated from the project and that will be used to model and characterize the aquifers and confining units in the region.

22274 (DOE/SR/15160–7-Vol.2) **Hydrogeologic investigation and establishment of a permanent multi-observational well network in Aiken, Allendale, and Barnwell Counties, South Carolina. Eight-year interim report (1986-1994). Volume 2 core description.** Gellici, J.A.; Reed, R.H.; Logan, W.R.; Aadland, R.K.; Simones, G.C. South Carolina Dept. of Natural Resources, Columbia, SC (United States). May 1995. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC09-86SR15160. Order Number DE95012405. Source: OSTI; NTIS; GPO Dep.

The South Carolina Department of Natural Resources, Water Resources Division (SCWRD), in collaboration with the United States Department of Energy (USDOE) is conducting a hydrogeologic investigation of the ground-water system(s) peripheral to the Savannah River Site (SRS). The study site is located in Aiken, Allendale, and Barnwell Counties, South Carolina. Ground-water movement, quality, and availability are being evaluated in order to better protect and manage this valuable regional resource. A series of well clusters are being installed outside the SRS as is described in Volume 1 of this report. At each cluster site, at least one borehole is continuously cored and geophysically logged from ground surface to 10 feet into unweathered bedrock. This report (Volume 2) contains the core descriptions of the "C-wells" completed to date.

22275 (DOE/SR/15191–T1) **Natural resources management activities and biodiversity maintenance. Progress report, July 1, 1994–June 30, 1995.** Caudell, M.B. South Carolina Dept. of Natural Resources, Columbia, SC (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-87SR15191. Order Number DE95012444. Source: OSTI; NTIS; GPO Dep.

This progress report for the Natural Resources Management Activities and Biodiversity Maintenance for the time period July 1, 1994 - June 30, 1995 was submitted to the DOE by the South Carolina Department of Natural Resources. The activities devoted to revitilization of wildlife areas and reintroduction of various animal species to wildlife areas (such as Crackerneck Wildlife Management Area) are described. Other information regarding site characterization, land use and resource management in South Carolina is provided. Also, a description of attendence to various meetings and certification seminars is covered.

22276 (ES/ER/TM–152) **Terrestrial mapping of the Oak Ridge Reservation: Phase 1. Environmental Restoration Program.** Washington-Allen, R.A. (Oak Ridge National Lab., TN (United States)); Ashwood, T.L.; Christensen, S.W.; Offerman, H.; Scarbrough-Luther, P. Oak Ridge National Lab., TN (United States). Jun 1995. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012979. Source: OSTI; NTIS; GPO Dep.

This report presents the results of the first phase in development of a habitat map of the terrestrial ecosystem on the Oak Ridge Reservation (ORR). During this phase, a satellite image of the ORR was classified into land use/land cover types, the classified image was incorporated into a geographic information system map of the ORR, and the accuracy of the map was assessed. A habitat map is a critical foundation for evaluation of the potential impact of historical (or ongoing) contamination on terrestrial biota of the ORR. The abundance and distribution of wildlife species and plant communities of concern are intrinsically linked to the abundance and distribution of habitat on which those species and communities rely. Thus, the impact of spatially discrete patches of contamination on those biota is directly proportional to the degree of overlap between habitat and contamination. Landsat 5 Thematic Mapper satellite imagery was used to create the land use/land cover map. A Thematic Mapper image consists of seven images of the same point on the earth produced by seven separate sensors, each of which detects a unique part of the electromagnetic spectrum. Separately and in various combinations, these spectral images can be correlated with vegetation type or other land cover type. The image selected for this map was from April 13, 1994, and covers 189,000 ha.

22277 (GSF–26/94) **Methods for the early recognition of substance translocations in soils on the basis of data provided by the soil information system.** Behrendt, H. (GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Projektgruppe Umweltgefaehrdungspotentiale von Chemikalien); Steindl, H.; Morgenstern, M. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Projektgruppe Umweltgefaehrdungspotentiale von Chemikalien. 1994. 352p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0339275A. Order Number DE95779666. Source: OSTI; NTIS (US Sales Only).

The aim of the project was to develop the bases for recognizing environmental hazard potentials from organic and inorganic chemicals at an early stage and to verify, or develop further, methods for forecasting substance translocations in soils on the basis of data provided by the soil information system "BIS". An important step in this direction was the quantification of uncertainties that these data included and the quantification of spatial variability, as demonstrated by the investigation of selected areas. These investigations served also to detect methodical uncertainties resulting from the use of models of different complexity. (orig.)

22278 (GSF–39/93, pp. 21-29) **Measuring wet deposition in alpine high elevation sites.** Smidt, S. (Forstliche Bundesversuchsanstalt, Wien (Austria). Inst. fuer Immissionsforschung und Forstchemie); Mutsch, F. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Wet deposition can add to the overall stress load of forest ecosystems. Its share in the overall deposition may fluctuate widely depending on area and altitude. A study was carried out in two higher alpine regions in order to measure the dependence of ion concentration and -carry-over on altitude. Results were compared with the results of two mountaneous regions in Bavaria, and two stations in the region of Leifers/Southern Tyrol for the period 1985-1988. Similar altitude dependence of mean ion concentration and element carry-over was found in the higher regions of the Ziller Valley and the Lavant Valley: ion concentrations decreased with increasing altitudes (exception: increasing proton concentrations) and an increase of proton carry-over with increasing altitude while the curves of sulphur and nitrogen carry-over were not very pronounced. Altitude curves of the parameters mentioned below taken in the Loisach Valley and Bad Reichenhall were different from the remaining stations. The mean quantity-weighted concentrations were as follows: 5-25mgH/l(pH:4.6-5.3), 0.5-2mg SO -S/l, 0.25-0.6mg NO -N/l, 0.25-0.8mg NH N/l. Mean annual carry-over was: 0.05-0.32 kg H/ha.a, 7-15kg S /ha.a, 7-17.5 kg N /ha.a. Comparison of the calculated mean carry-over by wet deposition of proton sulphur and nitrogen with the critical loads determined by UN-ECE showed that even at low degrees of pollution sensitive alpine forest ecosystems can be endangered by wet depositions. Precise determination of the danger to a certain site though wet deposition, however, requires a great deal of information about the site (eg. soil). In order to assess potential dangers from wet deposition of protons to forest soils in Austria one used parameters determined by the Austrian forest soil situation stocktaking study. (orig/EW)

22279 (GSF–39/93, pp. 49-57) **Carry-over of lead in the forest soils of northern and western Croatia.** Seletkovic, Z. (Forstwissenschaftliche Fakultaet, Zagreb (Croatia). Lehrstuhl fuer Waldbau); Prpic, B.; Komlenovic, N.; Rastoviski, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

A forest assessment study conducted in Croatia in 1992 found 46% of the forests to be damaged. The proportion of severely damaged trees (grade 21-4) rose from 10% in 1990 to 17% in 1992. In terms of her damaged forests Croatia has closed ranks with the most industrialised countries of Europe. The causes of tree death are studied intensively, this includes the lead contents in soil forests. In the course of 1992 we studied 54 areas out of the 16x16 grid. Here, we present the results of 28 test areas in beech forests. Soil samples were taken from micro locations near the foot of the beech trees, samples for comparison were taken from oh and ah horizons. In most areas lead concentrations at the foot of the tree were considerably higher than comparative values from the other samples. Mean lead concentration for 28 areas for of-horizons were 69.7mg Pb/kg, ah- horizon 55.4mg Pb/kg and values at microlocation were 152.4 mg Pb/kg and 11.4 mg Pb/kg. Forests in northern and western Croatia are most exposed to carry-over of lead. Especially in the forests of western Croatia this phenomenon is very prominent and increases with altitude. The link between lead concentration in the soil and altitude is clearly to be seen from the comparison of micro locations at both horizons (comparison -rof=0.72; rAh - 0.81, foot; rOf - 0.72; rAh = 0.76). In this report we relate tree damage and pollution and also look into other reasons of damage to forests. The forests of the western part of the country are the most damaged forests of the whole country. Damage of beeches and other trees increases with sea level. This, however, is not to say that lead content in the soil directly influences the state of the forest. (orig/EW)

22280 (GSF–39/93, pp. 64-77) **Chemism of wet deposition in the Italian Alps.** Mosello, R. (CNR Italienisches Inst. fuer Hydrologie, Pallanza (Italy)); Della Lucia, M.; Marchetto, A.; Tartari, G.A. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication SOILS/atmospheric precipitations; SOILS/deposition; ALPS/atmospheric precipitations; ITALY/alps; SOILS; DEPOSITION; ALPS; ITALY; SEASONAL VARIATIONS; PH VALUE; ELECTRIC CONDUCTIVITY; AMMONIA; CALCIUM; MAGNESIUM; POTASSIUM; SODIUM; SULFATES; NITRATES; CHLORIDES; ACID CARBONATES

22281 (GSF–39/93, pp. 90-99) **Pollutant carry-over and state of the soil in the forests of Baden-Wuerttemberg.** Hildebrand, E.E. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg (Germany). Abt. Bodenkunde und Waldernaehrung); Wilpert, K. v. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

State-wide monitoring systems in Baden-Wuerttemberg show that in large forest areas the soil's balancing function which assures balanced nutrition with potassium and/or magnesium is obviously limited. High reserves of nutrient in top soils can keep the nutrient cycle intact if general climatic conditions are favourable but the whole system becomes more destabilised and more dependent on natural and anthropogenic fluctuations or changes of factors at the location. In large areas present rates of deposition of forests overtax the forests' own buffer systems of digestions so that atmogenic immission-induced drift becomes likely. The intensity of these changes is obvious from the lowering of Ph-values on locations with sandstone over the last 70 years. Ph-values measured by

FRANK on 83 sandstone locations show that in 1927 the median of ph-distribution at 5 cm soil depth was ±6 and only a minor part of the frequency distribution was to be found in Ph-ranges where podsolation may take place. Ph-values measured at 63 sand stone profiles in 1992 show a completely different picture. The median of the frequency distribution is ±3.5, podsolation is now possible at all sites. Methodical effects cannot explain this divergence as ph-values of 1927 and 1992 do not differ on granite sites. Apart from the Ph-milieu we assume that carry-over of N most intensively changes the situation in forests. Nitrogen is the key element for an "unspecific triggering" of growth. This increases the need for neutral cations like Ca, K and Mg. Available resource of these elements however are scarce due to carry-over of acid and losses through utilisation. In many cases sufficient nutrition can only be managed by means of intensive root formation in the top soil. Especially ammonia act as acid carrier and this creates a divide of nutrition where even at normal growth rates forests become prone to nutritional disturbancies which may be triggered for instance by climatic stresses. (orig./EW)

22282 (GSF–39/93, pp. 100) **Measuring deposition in the forests of western Hungary.** Fuehrer, E.G. (Forstliche Versuchsanstalt, Sopron (Hungary)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; HUNGARY/forests; SOILS/deposition; SOILS/atmospheric precipitations; FORESTS; SOILS; OAKS; SPRUCES; BEECH TREES; HYDROGEN; SULFATES; NITRATES; AMMONIA; CALCIUM; MAGNESIUM; HUNGARY; DEPOSITION

22283 (GSF–39/93, pp. 101-105) **An overview of wet deposition of atmospheric trace pollutants in the Eastern Alpine region.** Kovar, A. (Ecosense, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; SOILS/atmospheric precipitations; SOILS/deposition; FORESTS; SOILS; DEPOSITION; AIR POLLUTION; ALPS; AIR POLLUTION MONITORING; RAIN; AMMONIA; SODIUM; POTASSIUM; CALCIUM; MAGNESIUM; CHLORIDES; NITRATES; SULFATES; GEOGRAPHICAL VARIATIONS; ANNUAL VARIATIONS; SEASONAL VARIATIONS

22284 (GSF–39/93, pp. 113-125) **Carry-over balances of dry and wet deposition in protected forests of the Swiss alpine region along the Gotthard-transect.** Graber, W.K. (Paul Scherrer Inst., Villigen-PSI (Switzerland)); Siegwolf, R.T.W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Risk assessment of anthropogenic and natural stress factors on the protected forests of the Alpine valleys is described. Assessment of carry-over over several decades makes it possible to indicate the risk in terms of actual load for individual parameters. Large spatial and temporal superposition of scales creates the necessity of using a great number of models each of which is adapted to a particular scale and show correct parametrisation. Evaluation of all risks that can be characterised in terms of a weighted synergistic overall risk for plant physiology will require intense additional efforts. (orig./EW).

22285 (GSF–39/93, pp. 170-178) **Results of the Austrian inventory of the state of forest soils.** Kilian, W. (Forstliche Bundesversuchsanstalt Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The nationwide inventory of the state of forest soils is part of a project of the Austrian Monitoring system of damage to forests and also part of the network of Austrian forest inventory. The extent of the inventory corresponds to Level II of the ECE-agreements on soil studies plus plant sociology, methods have been harmonised with those used within the ECE. 35% of all forest soils are influenced by carbonate, about 40% are quite able to withstand acidification. 23% show a high degree of acidification in the top soil and they are also drained of alkalines. About half of these soils are naturally acid for the other half we assume secondary acidification. Another group of soils show alkaline saturation which is just about satisfactory but these a prone to acidification. 10% of the soils are disposed to Mg-shortage. Effects of increased carry-over of N are not yet recognisable but a lack of N is widespread. Pb and Cd contents are often increased. Relative enrichment in humic topsoils and artificially applied humus as well as the significant increase of contents with sea level point to accumulation of Pb and Cd transported over large distances over large areas. Other heavy metals were measured but showed no significant increase, Zn and Cu tend to be scarce. (orig./EW).

22286 (GSF–39/93, pp. 179-191) **Results of a pilot study on a Swiss forest soil inventory.** Zimmermann, S. (Eidgenoessische Forschungsanstalt fuer Wald, Schnee und Landschaft, Birmensdorf (Switzerland)); Blaser, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

A pilot study on 100 selected forest soils was carried out in order to prepare a forest soil inventory in Switzerland. Soil profiles are located in five regions: Jura, Central area, pre-Alpine region, Alps and southern side of the Alps. The element lead is used to describe the possibilities of interpreting the element content found in the profile soils are influenced and draw conclusions with respect to anthropogenic soil pollution. The regulation on soil pollutants lists maximum values for 11 elements which apply to the content of a mixed sample from the top 20 cam of the soil. Nitric acid and sodium nitrate are recommended as extractants. Some problems

occured in assessing soil element contents on the basis of this regulation: all anorganic pollutants mentioned in the regulation are natural elements which occur in all soils in widely varying concentrations. Composition of the parent rock and resulting background concentrations therefore play a major role. Element contents in microsoils may also be strongly influenced by processes in the soil. De- and enrichment of elements compared to the parent rock can be estimated on the basis of the relative mobility of an element. Against this background it becomes clear that soil pollution can not be assessed on the basis of top soil samples alone. Only the distribution of an element across a whole profile allows to assess the proportion of the lithogenic share and an overall soil pollution. The results of the pilot study also showed that the profile data can only be interpreted properly if the extractants suggested in the regulation (nitric acid as strong and sodium nitrate as weak extractor) are supplemented by a "medium" extractor. We suggest to use ammonia-acetate-EDTA (see Lakanen and Ervioe.) The advantage of this method is that it does not affect non-weathered rock (except lime). Element contents extracted with this method allow better conclusions as to pedogenic and anthropogenic influences. (orig./EW)

22287 (GSF–39/93, pp. 192-193) **Results of a forest soil inventory in Southern Tyrol.** Huber, W. (Agrikulturchemisches Lab. Laimburg, Auer (Italy)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; FORESTS/soil chemistry; SOILS/italy; FORESTS; SOILS; ITALY; TERRESTRIAL ECOSYSTEMS; AIR POLLUTION MONITORING; ACIDIFICATION; LEAD; CADMIUM

22288 (GSF–39/93, pp. 206) **Forest soil inventory in Hungary.** Fuehrer, E.G. (Forstliche Versuchsanstalt, Sopron (Hungary)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; FORESTS/soil chemistry; SOILS/hungary; FORESTS; SOILS; HUNGARY; AIR POLLUTION MONITORING; TERRESTRIAL ECOSYSTEMS; PH VALUE; ACIDIFICATION

22289 (GSF–39/93, pp. 207-217) **Carry-over and dynamics of pollutants in two small catchment areas in Flysch (Tegernsee Alps).** Baeumler, R. (Lehrstuhl fuer Bodenkunde und Bodengeographie, Univ. Bayreuth (Germany)); Zech, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

This paper contains the results of a project carried out by the Federal Ministry of Research and Technology on "Soil research in the German Alpine Region". The water load in two forested small catchment areas in the Tegernsee Alps was studied in the compartments input, soil and output. The input is characterised by small overall deposition rate of proton and sulphur which total 0.6 kg H and 16 kg S ha^{-1} a^{-1}, but high overall deposition of N of up to 32 kg ha^{-1} a^{-1}. In the soil, the deposited nitrogen is almost completely transferred (plant absorption, microbial processes) and a strong release of Ca. Due to silicate weathering concentration of Si in the soil solution shows strong increase with rising depths. Subsequent decrease of 50% in receiving streams compared to soil solutions at a depth of 50 cm point to precipitation of silicate and new formation of minerals in the deeper decomposition hone. Output in receiving streams shows strong export of the alkaline cations Ca, Mg and Na with hydrogen carbonate as the corresponding anion. Protons, sodium and nitrogen are accumulated in the ecosystem. (orig./EW).

22290 (GSF–39/93, pp. 218-225) **Changing conditions of soils influences by beech trunk runoff in Slovakia.** Saly, R. (Lehrstuhl fuer Naturumwelt, Forstliche Fakultaet, TU Zvolen (Slovakia)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; SOILS/czech republic; SOILS/slovakia; BEECH TREES/soil chemistry; FORESTS; SOILS; SLOVAKIA; PH VALUE; CALCIUM; MAGNESIUM; POTASSIUM; ZINC; HUMUS

22291 (GSF–39/93, pp. 226-236) **Acid rain and resulting chemical composition of soils.** Ugolini, F.C. (Dipt. di Scienza del Suolo e Nutrizione della Pianta, Univ. Florenz (Italy)); Cecchini, G.; Buffoni, A.; Sanesi, G. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The input of free acids in the central and northern Appenine mountains is low and gets almost fully neutralised on its path through the vegetation. Nitrogen penetrating the ecosystem is largely accumulated. Soil solutions show low acidities and low aluminium contents. Formation of chelates of organic pollutant and stratification of vermiculite account for Al-immobilisation. At Monte Mottarone too, acid input which is considerably higher but neutralised during transition through the vegetation. A greater part of the ammonia is accumulated in the soil, a considerable output of nitrate takes place. This leads to strong acidification and mobilises large amounts of aluminium. (orig./EW).

22292 (GSF–39/93, pp. 237-247) **Pollution of forest ecosystems through deposition of sulphur, nitrogen and fluorine.** Kalan, J. (Inst. fuer Forst- und Holzwirtschaft, Ljubljana (Slovenia)); Simoncic, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil

pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; FORESTS/soil chemistry; SPRUCES/air pollution; FORESTS; SOILS; AIR POLLUTION MONITORING; BIOLOGICAL EFFECTS; PH VALUE; SULFUR; FLUORINE; SPRUCES

22293 (GSF–39/93, pp. 265-274) **Mineral nutrition and soil status in spruce forest ecosystems in the Bohemian forest in Upper Austria.** Katzensteiner, K. (Inst. fuer Waldoekologie, BOKU, Vienna (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Soil- and needle samples from fifty spruce stands stratified according to topography and soil water household and vitality characteristics of trees were analysed in order to determine the influences of general site parameters on soil properties, vitality and mineral nutrition of spruce stands under the influence of air pollutants with long-term effects. The multivariate statitical evaluation of the data showed a clear dependence of soil nutrient reserves on type of site and topography; soils in mountain top areas and at soils exposed to main wind directions were found to be most acidified. Lead accumulation in topsoils can be used as an indicator of immission, there is a clear link with sea levels and special pollution of exposed areas which leads us to the assumption that immissions play a role in soil acidification of these areas. Nutrition and vitality of these stands also correlates with general site parameters. Magnesia supply, which is most important for tree vitality is explained by soil parameters such as pH-value and magnesia reserves of the exchanger. Multiple regression models were used to gain information on the soil status of larger areas, provided that general site paramenters obtained from existing data such as the digital altitude model and site and stand maps are available. (orig./EW).

22294 (GSF–39/93, pp. 275-281) **Nitrogen carry-over in Swiss forest ecosystems and their importance for the nutritional status.** Flueckiger, W. (Inst. fuer Angewandte Pflanzenbiologie, Schoenenbuch (Switzerland)); Braun, S. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Deposition of nitrogen (NH_4^+, NO_3^-) was measured in several Swiss regions (transect Jura-Alpine region) in the open country (bulk) and in the canopies of spruces. The nutritional situation of beeches and spruces was studied at the same time. These studies were conducted over several years and show that the different regions have very different levels of N-carry-over. Nutrient studies carried out in 1984, 1987 and 1991 in the same tree collective of beeches and spruces in 60 areas under permanent monitoring show a significant increase of the N-content and a decrease of P- and Mg-contents in leaves and needles. As on results of N-increasing tests by means of appropriate forest shrubs we can assume that N-carry-over has an influence on the changing nutritional status of forest trees. (orig./EW).

22295 (GSF–39/93, pp. 283) **Carry-over and turnover of N in forest ecosystems of the Black Forest.** Zoettl, H.W. (Inst. fuer Bodenkunde und Waldernaehrungslehre, Albert-Ludwigs-Universitaet Freiburg im Breisgau (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soil chemistry; SOILS/nitrogen; SOILS/sulfur; FORESTS; SOILS; NITROGEN; SULFUR; FEDERAL REPUBLIC OF GERMANY; TERRESTRIAL ECOSYSTEMS; NUTRITIONAL DEFICIENCY; WATER CHEMISTRY; DEPOSITION

22296 (GSF–39/93, pp. 294-310) **Carry-over and carry-out of pollutants in the spruce ecosystem Wank (Kalkalpen) and assessment of their importance for soil and nutrition.** Liu, J.C. (GSF-Forschungszentrum fuer Umwelt und Gesundheit, Expositionskammern, Neuherberg/Oberschleissheim (Germany)); Keller, T.; Runkel, K.H.; Payer, H.D. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Carry-over and carry-out of pollutants were monitored over a period of 2 years in a 140-year old spruce stand in the Kalkalpen at an altitude of 800 m above sea level. Of the annual precipitation of 1243 mm one third is accounted for by evaporation though interception, half goes into the groundwater, one sixth is directly given back by evapotranspiration of plants and soil. Carry-over of all ions (H^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, NH^+, NO_3^-, Cl^-, SO_4^{2-}) proved to be so small that there is not recognisable pollution from carry-over of pollutants. There is a higher carry-out of Ca (23 keq*ha^{-1}*a^{-1}) only 7% of this can be accounted for by the carry-over of proton equivalents, more than 90% are due to carbonate dissolution and internal acid production in the soil due to high CO_2-concentrations. Development of soil acidity is therefore not controlled by acid carry-over bu t by internal processes of the system. Carry-over of nitrogen by precipitation on the stand it 18.7 kg*ha^{-1}*a^{-1}, of this NO_3-N: 10.4kg*ha^{-1}*a^{-1}, carry-out of N is 8.5 kg*ha^{-1}*a^{-1}. As the gaseous nitrogen balance is not known it is difficult to assess the N-household. Taking into account the insufficient supply of nitrogen to the spruces and the fact that at altitudes of 800 to 1700m above sea level there is a negative link between N-reserves in the soil and needle losses of spruces N-deposition at present cannot be assumed to have a negative effect on the forest. (orig./EW).

22297 (GSF–39/93, pp. 352-363) **Critical Loads for forest soils in Middle Europe.** Hojesky, H. (Bundesministerium fuer Umwelt, Jugend und Familie, Vienna (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP*

and ALPEN-ADRIA countries. Proceedings. Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Critical loads of acid carry-over in forest soils and surface water were calculated and mapped all over Europe within the programme "Mapping of Critical Loads and Levels" of UN-ECE. National results were mostly determined with the stationary mass balancing method which gives a simplified description of the chemical processes in the soil leading to acidification. The first results obtained with this method show that in Central Europe – especially in the Alpine regions and some forested areas in Germany with high amounts of precipitation – there are cases of unreasonably high critical loads which may not be able to ensure protection of sensitive ecosystems. Germany, Switzerland and Austria are the most affected states. They thried to improve the results by modifying the stationary mass balancing method. In March 1992 a workshop on this subject was held at the Federal Environmental Office in Vienna. Precise specification or variation of essential parameters of the mass balancing method (e.g. weathering rate) afforded improvements in terms of lower critical loads. Finally, we present an estimate on the influence of acid carry-over on growth losses. The results were obtained from a Swedish multi-layer soil model (PROFILE). (orig./EW)

22298 (GSF–39/93, pp. 406-415) **Ecosystem studies in the Kalkalpine Alpine region - altitude profile Achenkirch.** Herman, F. (Forstliche Bundesversuchsanstalt, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The interdisciplinary project "Ecosystem Studies in the Kalkalpin Alpine region - altitude profile Achenkirch" organised by the Bundesversuchsanstalt is the follow-up project of the "Altitude profile Zillertal" project whithin which the ecosystem of the Kalkalps has been continously studied since 1990. By including different reseach branches and by interdisciplinary evaluation of results one attempts to make a contribution to the protection of forests especially in terms of reafforestation in high altitudes and dynamics of forest ecosystems. Indicator values which characterise stresses of the ecosystem will be set up in order to provide a basis for legal measures. (orig./EW)

22299 (GSF–39/93, pp. 437-447) **Investigations of geochemical processes in oak stands, with particular regard to the deposition of atmospheric pollutants.** Berger, T.W. (Inst. fuer Waldoekologie, Univ. fuer Bodenkultur, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Goechemical processes in declining Cental European oak ecosystems (Quercus petraea and Q. robur) were studied in two oak stands of the Weinviertel, Lower Austria, about 30 km north of Vienna. Stores of chemical elements were determined by soil and biomass inventories. Deposition input was monitored over a two-year period by bulk sampling of throughfall. Soil solution chemistry was studied by tension lysimetry over a one-year period. Mineral nutrition of oak was judged by foliar analysis. Bulk deposition rates were 10 - 12 kr $N.ha^{-1}.a^{-1}$, and 15 - 20 kg $S.ha^{-1}.a^{-1}$. Both systems can be assumed to be S-saturated. Based on this assumption, the total nitrogen gain was estimated as 12 kg $N.ha^{-1}.a^{-1}$ at one site and 21 kg $N.ha^{-1}.a^{-1}$ at the second. Both systems lose calcium and magnesium. Foliar nutrient levels indicate sufficient nutrition with main mineral nutrients, except for magnesium, which is in moderately low supply. Based on these findings, the hypothesis that pollutant deposition is the cause of a sudden and severe appearance of decline symptoms in the second half of the 1980ties, must be dismissed. The data on deposition rates and ecosystem nutrient status, however, indicate, that the soil of both systems is acidifying, nitrogen stores are increasing, and magnesium pools are depleted. If deposition of pollutants continues at current rates, a slow but steady degradation of many oak ecosystems in the Austrian Weinviertel is inevitabel. (orig.)

22300 (GSF–39/93, pp. 449-452) **Atmospheric deposition in the Erzgebirge, Czech Republic.** Cerny, J. (Cesky Geologicky Ustav, Praha (Czech Republic)); Groscheova, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The atmospheric sulphur deposition in the Erzgebirge today (found as carry-over in precipitations below canopy level)is not extremely increased compared to the values indicated for spruce stands in Europe even though air pollution in the Czech Republic is significantly higher. The reason for this is mostly likely the thinning of the canopy which cannot absorb pollutants efficiently any more. In younger, well kept stands atmospheric deposition is almost twice as high as in old damaged stands. The present amount of atmospheric deposition in old spruce stands is not worrying even though it is probable that unless today's pollution levels can be reduced, younger forests will be damaged by the high atmospheric deposition. (orig./EW)

22301 (GSF–39/93, pp. 474-480) **Concentrations of minerals in ombrogenous peat bog lays as an indicator of recent and past deposition.** Goerres, M. (Inst. fuer Botanik, Univ. Hohenheim, Stuttgart (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The ash and element content (22 elements) of ombrogenous peat bog lays was determined for six southern German and various central and northern European peat bogs in higher altitudes. Depth profiles show a clear connection between anthopogenic substance carry-over (agriculture, clearing) and increased ash- and element contents. Pb-contents of the upper layers of the peat bogs are clearly higher in industrialised regions. Pb-contents increase with precipitation. The change of vegetation observed in many ombrogenous peat bogs and the increasing growth of trees can be related to increased contents of ash and elements. Further reduction of emissions is desirable for the sensitive ecosystems of peat bogs. (orig./EW)

22302 (GSF–39/93, pp. 494-498) **Regional estimation models for carry-over of pollutants and forest soil pollution in Southeastern Bavaria.** Lenz, R. (GSF - Forschungszentrum fuer Umwelt und Gesundheit, GmbH, Projektgruppe Umweltgefaehrdungspotentiale von Chemikalien (PUC), Neuherberg,

Oberschleissheim (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Three maps are presented which were drawn on the basis of a geographic information system and regional estimation models for Southeastern Bavaria. The following characteristics and pollutions of forest ecosystems which are relevant for the metabolism in the medium and longterm: deposition risk classes for protons, weathering rates (classes) for soils, long-term pollution risks of acid carry-over. 41% of the forest area shows a low risk, and 6% show a mean risk of acidification due to pollution carry-over from air. These results must be seen as preliminary, regional mean values. (orig./EW)

22303 (GSF–39/93, pp. 506-510) **Deposition of elements in forests and chemical composition of the forest soil in Southern Bohemia.** Lochman, V. (Forschungsinstitut der Forst- und Wildverwaltung, Prag (Czech Republic)); Biba, M.; Bucek, J. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/soils; FORESTS/soil chemistry; FORESTS; SOILS; DEPOSITION; ATMOSPHERIC PRECIPITATIONS; ACIDIFICATION; AIR POLLUTION; AIR POLLUTION MONITORING; SPRUCES; BEECH TREES

22304 (GSF–39/93, pp. 522-526) **A method for quantifying the most important mechanisms of acid buffering in carbonate-free soils.** Sand, M. van de (Inst. fuer Bodenkunde, Univ. Hohenheim, Stuttgart (Germany)); Fischer, W.R. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication SOILS/acid neutralizing capacity; GRANITES/soil chemistry; SANDSTONES/soil chemistry; SOILS; ALUMINIUM; IRON; TITRATION; BUFFERS; GRANITES; SANDSTONES; FEDERAL REPUBLIC OF GERMANY

22305 (IC–95/51) **Using saturation water percentage data to predict mechanical composition of soils.** Mbagwu, J.S.C. (International Centre for Theoretical Physics, Trieste (Italy)); Okafor, D.O. International Centre for Theoretical Physics, Trieste (Italy). Apr 1995. 16p. Order Number DE95633181. Source: OSTI; NTIS (US Sales Only); INIS.

One hundred and sixty-six soil samples representing eleven textural classes and having wide variations in organic matter (OM) contents and other physico-chemical properties were collected from different locations in southeastern Nigeria to study the relationship between mechanical composition and saturation water percentage (SP). The objective was to develop a prediction model for silt + clay (SC) and clay (C) contents of these soils using the SP values. The magnitude of the correlation coefficients (r) between SC or C and SP was dependent on the amount of organic matter (OM) present in the soils. For soils with $\leq$ 1.00% OM, the correlation (r) between SC and SP was 0.9659 ($p \leq 0.001$) and that between C and SP was 0.9539 ($p \leq 0.001$). For soils with $\geq$ 2.00% OM, the 'r' values were generally low, varying between 0.5320 and 0.2665 for SC and 0.6008 and 0.3000 for C. The best-fit regression models for predicting SC and C were developed with soils having $\leq$ 1.00% OM. An independent data set from 25 soil samples collected from other parts of the study area was used to test the predictive ability of the best-fit models. These models predicted SC and C accurately in soils having between 0.28 and 1.10% OM, but poorly in soils having between 1.31 and 3.91% OM. These results show that the use of saturation water percentage to predict the mechanical composition of soils is most reliable for soils with low ($\leq$ 1.00%) OM contents. (author). 18 refs, 2 figs, 5 tabs.

22306 (INIS-mf–14533, pp. 115) **The main factors of natural rehabilitation of the contamination territories.** Sobotovich, Eh.V. (Otdelenie Radiogeokhimii Okruzhayushchej Sredy IGMR NAP Ukrainy, Kiev (Ukraine)). Ministehrstva pa Nadzvychajnykh Situatsyyakh i Abarone Nasel'nitstva ad Vynikaw Katastrofy na Charnobyl'skaj AEhS Rehspubliki Belarus', Minsk (Belarus); Akadehmia Navuk Belarusi, Minsk (Belarus). Apr 1995. 141p. (In Russian). (CONF-9504159–: Ecological status of territories polluted by radionuclides, Minsk (Belarus), 19-20 Apr 1995). In *Abstracts of papers of International Meeting 'Ecological status of territories polluted by radionuclides'.* Order Number DE95629235. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHERNOBYLSK-4 REACTOR/contamination; DECONTAMINATION/efficiency; CONTAMINATION; DECONTAMINATION; EFFICIENCY; ECOSYSTEMS; RADIONUCLIDE MIGRATION

22307 (INIS-RU–406, pp. 22-23) **Differential biotesting of radiation and chemical contaminants of the environment.** Synzynys, B.I. (Inst. Atomnoj Ehnergetiki, Obninsk (Russian Federation)); Egorova, E.I.; Lapina, N.F.; Pelevina, I.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BIOLOGICAL INDICATORS/contamination; CONTAMINATION/soils; CONTAMINATION/water; CONTAMINATION; BIOLOGICAL RADIATION EFFECTS; CHERNOBYLSK-4 REACTOR; SOILS; WATER; DOSE-RESPONSE RELATIONSHIPS; ENZYME ACTIVITY; GAMMA RADIATION; MAIZE; RADIOACTIVITY; RADIOECOLOGICAL CONCENTRATION; RADIOISOTOPES; REACTOR ACCIDENTS; ROOT ABSORPTION; WHEAT; X-RAY FLUORESCENCE ANALYSIS

22308 (INIS-RU–406, pp. 64) **Ion exchange unit for removal of radionuclides from milk.** Donskaya, G.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MILK/decontamination; RADIOISOTOPES/ion exchange; CESIUM ISOTOPES; CHERNOBYLSK-4 REACTOR; EFFICIENCY; IODINE ISOTOPES; MILK; DECONTAMINATION; ORGANIC ION EXCHANGERS; PILOT PLANTS; RADIOACTIVE WASTE DISPOSAL; RADIOISOTOPES; REACTOR ACCIDENTS; STRONTIUM ISOTOPES

22309 (INP–1615/D) **Natural factors of ^{137}Cs redistribution in soil (case study from the Carpathian Foothills).** Chelmicki, W. (Uniwersytet Jagiellonski, Cracow (Poland)); Swiechowicz, J.; Mietelski, J.W.; Macharski, P. Institute of Nuclear Physics, Cracow

(Poland). 1993. 19p. Order Number DE95632292. Source: OSTI; NTIS; INIS.

Pre- and post-Chernobyl accident.

Total ^{137}Cs as well as the pre- and post-Chernobyl ^{137}Cs redistributions in soil for the single forester slope situated in the Carpathian Foothills were analysed according to the relief conditions, humus content and soil permeability. It was found that in spite of the relatively uniform environmental conditions the ^{137}Cs redistribution is not uniform. This could be attributed to geomorphic processes such as soil erosion on slope (which is most intensive on the convex-shaped midslope) and to the soil deposition at the foot and the valley bottom. The ^{137}Cs activity correspond to the humus content and, to some extent, to the soil permeability. The role of other factors in the vertical migration of the isotope remains unknown. (author). 11 refs, 8 figs, 7 tabs.

22310 (JAERI-Research–95-024) **Studies on sorption behaviour of technetium in soils.** Takebe, Shinichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Xia Deying. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 19p. Order Number DE95780611. Source: OSTI; NTIS; INIS.

The technetium sorption behaviour in different soils has been studied by batch experiments under aerobic conditions. The soil samples characteristics and soil preequilibrium water properties of pH-Eh have been also investigated. In addition, the activated carbon and reduced iron powder have been selected as the additives to the JAERI sand according to the research work, and the technetium sorption behaviour in the artificial soils has been studied in the similar conditions. The experiment results show that all soils except for gley soil have little distribution coefficient for Tc, while the artificial soils have very high distribution coefficient for Tc. The distribution coefficient Kd values have an increase trend with the additive increase in artificial soils and contact time. Physicochemical processes of fixation and possible sorption modes are discussed as well. (author).

22311 (LA-SUB–95-27-1) **SAMFT1D: Single-phase and multiphase flow and transport in 1 dimension. Version 2.0, Documentation and user's guide.** Wu, Y.S. (HydroGeoLogic, Inc., Herndon, VA (United States)); Huyakorn, P.S.; Panday, S.; Park, N.S.; Kool, J.B. Los Alamos National Lab., NM (United States); HydroGeoLogic, Inc., Herndon, VA (United States). Sep 1991. 297p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95007639. Source: OSTI; NTIS; GPO Dep.

This report documents a one-dimensional numerical model, SAMFT1D, developed to simulate single-phase and multiphase fluid flow and solute transport in variably saturated porous media. The formulation of the governing equations and the numerical procedures used in the code for single-phase and multiphase flow and transport are presented. The code is constructed to handle single-phase as well as two or three-phase flow conditions using two integrated sets of computational modules. The fully implicit scheme is used in the code for both single-phase and multiphase flow simulations. Either the Crank-Nicholson scheme or the fully implicit scheme may be used in the transport simulation. The single-phase modules employ the Galerkin and upstream weighted residual finite element techniques to model flow and transport of water (aqueous phase) containing dissolved single-species contaminants concurrently or sequentially, and include the treatment of various boundary conditions and physical processes. The multiphase flow modules use block-centered finite difference techniques to simulate two or three-phase flow problems, and treat different boundary conditions in terms of source/sink terms fully implicitly. Whereas the multiphase solute transport modules employ finite element schemes to handle single-species transport in multiphase fluid systems. This document has been produced as a user's manual. It contains detailed information on the code structure along with instructions for input data preparation and sample input and printed output for selected test problems. Also included are instructions for job set up and simulation restart procedures.

22312 (LBL–36807) **Transient dual-porosity simulations of unsaturated flow in fractured rocks.** Zimmerman, R.W.; Hadgu, T.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (United States). Jan 1995. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012438. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the development and use of a semi-analytical dual-porosity simulator for unsaturated flow in fractured rock masses. Fluid flow between the fracture network and the matrix blocks is described by a nonlinear equation that relates the imbibition rate to the local difference in liquid-phase pressure between the fractures and the matrix blocks. This equation is a generalization of the Warren-Root equation, but is accurate in both early and late time regimes. The fracture/matrix interflow equation has been incorporated into a computational module that acts as a source/sink term for fracture elements; this module is compatible with the unsaturated flow simulator TOUGH. Flow processes are then simulated using only fracture elements in the computational grid. This semi-analytical dual-porosity module has been tested with TOUGH on various problems involving transient flow in fractured/porous media, and compared with simulations performed using explicit discretization of the matrix blocks. The new semi-analytical dual-porosity model accurately simulates flow processes in unsaturated fractured rocks, and typically requires an order of magnitude less computational time than do simulations using fully-discretized matrix blocks.

22313 (LBL–36825) **A joint Russian-American field test at the Chelyabinsk-65 (Mayak) Site: Test description and preliminary results.** Wollenberg, H. (and others); Tsang, C.F.; Frangos, W. Lawrence Berkeley Lab., CA (United States). May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (RAC–12; CONF-950917–11: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95012351. Source: OSTI; NTIS; INIS; GPO Dep.

In September 1994, a Russian-American team conducted hydrogeological, geochemical, geophysical, and radiometric measurements in the territory of the Mayak Production Association. The primary purpose of these operations was to examine the groundwater plume moving from Lake Karachai toward the river. Activities encompassed isolation of hydrologic intervals in two wells and production of water from these intervals, to compare isolated versus open-well sampling methods; surface and soil-water sampling, accompanying radiometric measurements and subsequent chemical analyses; and electrical resistivity profiling in areas of expected contrasting resistivity. Preliminary results indicate that (1) ^{60}Co and ^{137}Cs are present in small concentrations in water of the Mishelyak River, (2) analyses of water samples collected by a downhole sampler and of water produced from packed-off intervals agree within limits of laboratory accuracy, attesting to the efficacy of the sampling methods presently used by the Russian workers; and (3) strong contrasts occur between the electrical resistivities of soil and bedrock. Further collaborative work is strongly recommended, and should include more detailed isolation of intervals in wells by multi-packer installations, to better determine the geochemical and hydrological characteristics of the Karachai-Mishelyak system; deployment of a broader soil-water and soil sampling array; a more detailed examination of the distribution and concentration of radionuclides by high-resolution field gamma spectrometry; and a detailing of the area's electrical resistivity setting, using a mobile electromagnetic measurement system.

22314 (LBL–36831) **Discriminating effects of heterogeneity and matrix diffusion by alternative tracer designs.** Tsang, Y.Y.W. Lawrence Berkeley Lab., CA (United States). Mar 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012376. Source: OSTI; NTIS; GPO Dep.

Flow and transport calculations are carried out by numerical simulation for different tracer designs: single-well radially diverging/converging (huff-puff), single well radially converging, and two-well injection-withdrawal (doublet) in a 2D fracture zone. The fractured rocks are conceptualized as a dual-continuum: the well-connected fractures forming a heterogeneous continuum for advective transport, and the less permeable matrix forming a second continuum for tracer diffusion. Results show that the huff-puff design can be a

good diagnostic test for matrix diffusion. The two-well doublet design averages over a large volume and corrects for the extreme sensitivity to spatial heterogeneities of the single well converging test, but requires prior knowledge of presence or absence of matrix diffusion to give reliable estimate of transport parameters. Results of this study demonstrate that using a suite of different tracer designs is important to reduce the uncertainty in association with solving the inverse problem of tracer test interpretation to characterize transport in fractured rocks.

22315 (LBL–37004) **Degassing and two-phase flow pilot hole test report.** Geller, J.T. (Lawrence Berkeley Lab., CA (United States)); Jarsjoe, J. Lawrence Berkeley Lab., CA (United States). Mar 1995. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012361. Source: OSTI; NTIS; GPO Dep.

A pilot hole test was conducted to support the design of the Degassing of Groundwater and Two-Phase Flow experiments planned for the Hard Rock Laboratory, Aespoe, Sweden. The test consisted of a sequence of constant pressure borehole inflow tests (CPTs) and pressure recovery tests (PRTs) in borehole KA2512A. The test sequence was designed to detect degassing effects from the change in transmissivity, or hydraulic conductivity, and storativity when the borehole pressure is lowered below the groundwater bubble pressure. The entire 37.3m of the borehole section was tested without packers. Flow response to pressure changes in CPTs occurred rapidly. Flowrates fluctuated before attaining a steady trend, probably due to effective stress changes when borehole pressure was reduced for the first time. These factors decreased the sensitivity of type-curve fits to values of specific storage. The relationship between borehole pressure and steady-state flowrates was linear over borehole pressures of 1500 kPa (abs) down to 120 kPa (abs) during testing in December 1994, indicating that processes that may change hydraulic conductivity at low borehole pressures, such as degassing, calcite precipitation or turbulence, did not occur to a measurable degree. Test results during January and February of 1995 suggest that degassing may have occurred. The hydraulic conductivity measured at a borehole pressure equal to 120 kPa (abs) was 20% lower than the hydraulic conductivity measured at a borehole pressure of 1500 kPa (abs); the latter value was 10% lower than the hydraulic conductivity measured in December, 1994. The volumetric gas content measured during this time was 1% v/v. Pressures in monitoring well KA2511A responded to the testing in KA2512A. Step-changes in flowrates coincided with blasting at 3300-3400 m tunnel length. The magnitude of these changes was greater at the lower borehole pressures. Step increases in pressures in KA2511A also coincided with the blasts.

22316 (NEI-DK–1990) **Heavy metal migration in soil. An experimental evaluation at two metal recycling industries.** Arbejdsrapport fra Miljoestyrelsen, 16. Jensen, D.L. (Technical University of Denmark. Institute of Environmental Science and Engineering, Lyngby (Denmark)); Holm, P.E.; Christensen, T.H. Miljoestyrelsen, Copenhagen (Denmark). 1995. 60p. Order Number DE95779154. Source: OSTI; NTIS.

Laboratory and field investigations were made at two metal recycling sites in order to evaluate the risk of heavy metal migration to groundwater. The top soils at both sites contained very high concentrations of lead, copper and zinc, high concentrations of nickel, cadmium and chromium and somewhat elevated concentrations of many other metals. Investigations focused on lead, copper and zinc. The leachate from soils representing different metal recycling activities at the sites (scrap cutting, car-battery destruction, cable burning and general activities including storage) as obtained from column leaching test in the laboratory showed in most cases only slightly elevated concentrations of dissolved metals (< 10 times) as compared to the leachates from uncontaminated reference soils. Soil and soil water sampled at several profiles at the two metal recycling sites confirmed the indications obtained from the leaching tests: The metals had migrated less than 0.5 m below the surface during approximately 25 years of activity at the sites, except at the car-battery destruction locations. The investigation concludes that the risk of metal migration to the groundwater is limited as long as pH stays high in the top soils containing very high metal concentrations. The now abandoned car-battery destruction directly on the ground surface has lead to very high concentrations of metals in the soil and migration of metals that may affect the groundwater. However, the extend of the metal plume in the groundwater was not investigated. (EG)

22317 (NEI-DK–2020) **Bioremediation of contaminated soil. Development and application of technologies.** Arbejdsrapport fra Miljoestyrelsen, 4/1995. Aamand, J (Water Quality Institute (Denmark)); Jensen, B.K.; Kvistgaard, M. Miljoestyrelsen, Copenhagen (Denmark). 1995. 58p. Order Number DE95787782. Source: OSTI; NTIS.

Bioremediation is a technology for remediation of soil contaminated by hazardous waste chemicals. The application of specific degrading bacteria for the treatment of polluted soil is emphasized. The current market and regulatory framework related to bioremediation are evaluated. Soil polluted by benzene, toluene, ethylbenzene, xylene (BTEX) and light fuel oil often contains indigenous hydrocarbon-degrading bacteria, and degradation is limited by the availability of oxygen or other factors. The degrading biomass may be inhibited or absent in soil heavily polluted by creosote or coal tar, and inoculation may initiate the degradation process. An inoculum may include a range of different bacterial strains. Fungi are more versatile. The degradation of tetrachloroethylene, trichloroethylene, and 1,1,1-trichloroethane in the environment is limited by the lack of effective degrader organisms. A TCE-degrading bacteria that grows on lactate has been constructed by genetic engineering, and research is being carried out to develop a bacteria with the capability to use the chlorinated aliphatics as growth substrates. Deviations in national guidelines for treatment of contaminated soil may inhibit the technical development of a bioremediation technology. Acceptance of high levels of rest contaminations in particular regions attract foreign soil, creating trans-national transport of polluted material. Prices of treatment are kept artificially low, and competitive incentives, such as technical developments, are inactivated. For easily degradable compounds such as BTEX and light fuel oil the advantages of inoculation of soil with specific degrading organisms are limited. (AB) (19 refs.)

22318 (NILU-OR–17/94, pp. 159-160) **Critical loads for forest soils: acid deposition, nitrogen saturation and forest vitality.** Frogner, T. (Norwegian Forest Research Inst. (Norway)); Wright, R.F.; Nellemann, C.; Esser, J.M.; Cosby, B.J. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9403229–: Long-range transported pollutants. Supplies, effects and critical loads, Grimstad (Norway), 7-9 Mar 1994). In *Long-range transported pollutants. Supplies, effects and critical loads.* 210p. Order Number DE95779285. Source: OSTI; NTIS.

Acid deposition damages lakes, forest soils and vegetation: Reduction in the emissions of S and N are required. Protocols within the framework of United Nations Economic Commission for Europe are being negotiated to reduce the emission of sulphur and nitrogen based on the concept of critical load. Acidification of lakes and damage to fish is well correlated with critical loads for water. The link between defoliation and critical loads for forest soils, however is more difficult to establish. The dynamic model MAGIC is used to calculate the critical loads for forest soils for present-day acid deposition and future scenarios of deposition and nitrogen retention. MAGIC includes time-dependent aspects such as cation exchange and anion adsorption, and also forest growth. The calculations are based on soil survey data of NIJOS, the atmospheric data of NILU, the forest productivity data of NIJOS, and the surface water chemistry data of NIVA. The criterion used was that the Ca/Al-molar ratio in soil solution should not fall beneath 1.0 in the uppermost 50 cm of soil for at least 50 years into the future. 2 refs.

22319 (NILU-OR–17/94, pp. 201-205) **Factor analysis of NMHC and ozone measured at Birkenes in South Norway.** Solberg, S. (Norwegian Inst. for Air Research, Kjeller (Norway)); Stordal, F.; Schmidbauer, N.; Pedersen, U. Norsk Inst. for Luftforskning, Kjeller (Norway). Mar 1994. (CONF-9403229–: Long-range transported pollutants. Supplies, effects and critical loads, Grimstad (Norway), 7-9 Mar 1994). In *Long-range transported pollutants. Supplies, effects and critical loads.* 210p. Order Number DE95779285. Source: OSTI; NTIS.

The seasonal and geographical distribution of sources of NMHC (non-methane hydrocarbons) was estimated from the measurements at Birkenes in Southern Norway by use of factor analysis. The correlation between surface ozone and NMHC was also studied. Nine hydrocarbons and ozone were grouped into different factors each season, and the relative significance of the factors in different transport sectors was calculated. The most significant factor in all the four seasons was the 'unburned fuel factor', consisting of butanes and pentanes, which in some seasons was mixed with engine exhaust components. Ozone was anticorrelated with the 'traffic factor' in autumn and winter and positively correlated with this factor in summer. The unburned fuel factor was relatively more important in the transport sector SW, while the traffic factor was more important in the sectors S and SE. 5 refs., 2 figs., 2 tabs.

22320 (NILU-OR–25/94) **Terrestrial monitoring programme. Monitoring of chemical precipitation connected to field research areas 1993.** Toerseth, K.; Roestad, A. Norsk Inst. for Luftforskning, Kjeller (Norway). May 1994. 72p. (In Norwegian). Order Number DE95779276. Source: OSTI; NTIS.

The report deals with a terrestrial monitoring programme in Norway. Within the programme, the Norwegian Institute for Air Research (NILU) performed precipitation sampling and chemical analysis in seven experimental fields in 1993. Weekly precipitation samples are analyzed for all main ions, and monthly samples for different trace elements. The highest depositions of sulphur- and nitrogen-components were, as normally, largest during the winter and fall season. The total depositions are air pollutants in 1993 were due to small precipitation amounts in Southern Norway, the lowest observed since NILU started precipitation analysis early in the seventies. In the central and northern part of Norway the depositions were at the same level as in the two previous years. Also the levels of lead, copper and zinc in precipitation are significantly higher in southern Norway than in the central part of Norway. The monthly mean concentrations of Ni, As, Co, Cr and Fe are mostly measured to be below the detection levels at all sites. 7 figs., 4 tabs.

22321 (NREL/TP–430-7973) **Effect of leachate recirculation on landfill gas production and leachate quality: A controlled laboratory study.** Bogner, J.; Spokas, K. National Renewable Energy Lab., Golden, CO (United States). May 1995. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009215. Source: OSTI; NTIS; GPO Dep.

This report summarizes the results of a laboratory study conducted during 1992-1994 at Argonne National Laboratory. The study examined biogas production and leachate chemistry in parallel anaerobic assays run under either leachate recycle or leachate drainage regimes over a period of 400 days. A standardized synthetic refuse (paper, grass, food) was used in an experimental design which evaluated two elevated moisture contents and two added soils. All assays were conducted in vitro in 125 mL serum bottles. Four recycle/drainage events were completed during the 400 days of this experiment. Sufficient replicates (10 or 20) for each trial were included in the experimental design to permit destructive sampling of assay solids after each recycle/drainage event. Changes in the chemistry of solid, liquid, and gaseous phases were evaluated during the decomposition process. Analyses included major gases (CH_4, CO_2, O_2, N_2), selected chemical constituents of leachate (C1-C5 carboxylic acids, total organic carbon, Kjeldahl nitrogen, total phosphorus, iron, zinc, and chloride), leachate pH and conductivity, and selected solids analysis (gravimetric moisture content, volatile solids, total carbon, cellulose, hemicellulose, and lignin).

22322 (ORNL/CDIAC–79) **Continental scale estimates of the biotic carbon flux from land cover change: 1850 to 1980.** Daniels, R.C. (ed.) (Oak Ridge National Lab., TN (United States)); Houghton, R.A.; Hackler, J.L. Oak Ridge National Lab., TN (United States). Mar 1995. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NDP–050). Order Number DE95012262. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 4379.

This document describes a Numeric Data Package (NDP) that contains annual carbon flux estimates from land cover change for nine regions of the world (i.e., North America, Europe, the Former Soviet Union, Pacific Developed Region, China, South and Central America, North Africa-Middle East, Tropical Africa, and South and Southeast Asia). Annual rates of land cover change and vegetation-soil response curves for each region and ecosystem are included in the database. The vegetation-soil curves are used in a bookkeeping carbon model to estimate the carbon flux with the atmosphere from the clearing or degradation of vegetation, cultivation of soils, decay of dead vegetation, and the recovery of abandoned lands. The model calculates the net flux of carbon in each region based on land cover change rates and vegetation-soil response curves for the period 1850 to 1980 (a few regions have WA cover records beginning in 1700 and carbon flux estimates ending in 1990). These data were collected and modeled in an attempt to reduce the uncertainty associated with the magnitude and time course of the flux of carbon from terrestrial vegetation to the atmosphere.

22323 (PNL–9224) **Initial field test of High-Energy Corona process for treating a contaminated soil-offgas stream.** Shah, R.R.; Garcia, R.E.; Jeffs, J.T.; Virden, J.W.; Heath, W.O. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95010721. Source: OSTI; NTIS; INIS; GPO Dep.

The High-Energy Corona (HEC) technology for treating process offgases has been under development at Pacific Northwest Laboratory (PNL) since 1991. The HEC process uses high-voltage electrical discharges in air to ionize the air, forming a low-temperature plasma that would be expected to destroy a wide variety of organic compounds in air. The plasma contains strong oxidants, possibly including hydroxyl radicals, hydroperoxy radicals, superoxide radicals, various excited as well as ionized forms of oxygen, high-energy electrons, and ultraviolet (UV) light. Because the high-voltage plasma is produced near ambient temperatures and pressures, yet exhibits extremely rapid destruction kinetics with relatively low power requirements, the HEC technique appears promising as a low-cost treatment technique (Virden et al. 1992). As part of the Volatile Organic Compound (VOC) Nonarid Integrated Demonstration (ID) at the DOE Savannah River Site, research activities were initiated in December 1991 to develop a prototype HEC process for a small-scale field demonstration to treat a soil-offgas stream contaminated with trichloroethylene (TCE) and perchloroethylene (PCE) at varying concentrations. Over an 18-month period, the HEC technology was developed on a fast track, through bench and pilot scales into a trailer-mounted system that was tested at the Nonarid ID. Other national laboratories, universities, and private companies have also participated at the Nonarid ID to demonstrate a number of conventional, emerging and innovative approaches for treating the same soil-offgas stream.

22324 (PNL–10534) **Uranium characterization at the St. Louis Airport Site.** Schilk, A.J. (Pacific Northwest Lab., Richland, WA (United States)); Hubbard, C.W.; Bowyer, T.W.; Reiman, R.T. Pacific Northwest Lab., Richland, WA (United States). May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012232. Source: OSTI; NTIS; INIS; GPO Dep.

In support of the Department of Energy/Office of Technology Development's Expedited Site Characterization (ESC) project (coordinated by Ames Laboratory), the Pacific Northwest Laboratory demonstrated two complementary technologies at the St. Louis Airport (SLAP) site that have been designed and optimized for the rapid, in situ quantification of radionuclide contamination in surface soils. The sensors are optimized for the detection of high-energy beta particles or gamma rays emitted from the decay of specific radionuclides of interest. These technologies were demonstrated by measuring the beta and gamma fluxes at several locations within the SLAP site. Measurements were converted to average contamination levels, using detector calibrations performed with spiked samples (beta) or sealed sources (gamma). Additionally, subsurface activity levels were derived from discrete soil samples (provided by the ESC field crew) via gamma-ray spectrometry in a controlled laboratory setting. Since the beta and gamma sensor technologies are intrinsically sensitive to different types of radiation

and activity distributions (i.e., surface and shallow subsurface, respectively), the data obtained from the two detectors provide complementary information about the distribution of the contamination. The results reported here suggest that a number of locations within the SLAP site have elevated levels of ^{211}U, and the differences between the beta and gamma activities indicate that the contamination is largely located near the surface of the soil.

22325 (PNL–10550) **Environmental settings for selected US Department of Energy installations - support information for the programmatic environmental impact statement and the baseline environmental management report.** Holdren, G.R.; Glantz, C.S.; Berg, L.K.; Delinger, K.; Fosmire, C.J.; Goodwin, S.M.; Rustad, J.R.; Schalla, R.; Schramke, J.A. Pacific Northwest Lab., Richland, WA (United States). May 1995. 458p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012478. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the environmental setting information developed for 25 U.S. Department of Energy (DOE) installations in support of the DOE's Programmatic Environmental Impact Study (PEIS) and the Baseline Environmental Management Report (BEMR). The common objective of the PEIS and the BEMR is to provide the public with information about the environmental contamination problems associated with major DOE facilities across the country, and to assess the relative risks that radiological and hazardous contaminants pose to the public, onsite workers, and the environment. Environmental setting information consists of the site-specific data required to model (using the Multimedia Environmental Pollutant Assessment System) the atmospheric, groundwater, and surface water transport of contaminants within and near the boundaries of the installations. The environmental settings data describes the climate, atmospheric dispersion, hydrogeology, and surface water characteristics of the installations. The number of discrete environmental settings established for each installation was governed by two competing requirements: (1) the risks posed by contaminants released from numerous waste sites were to be modeled as accurately as possible, and (2) the modeling required for numerous release sites and a large number of contaminants had to be completed within the limits imposed by the PEIS and BEMR schedule. The final product is the result of attempts to balance these competing concerns in a way that minimizes the number of settings per installation in order to meet the project schedule while at the same, time providing adequate, if sometimes highly simplified, representations of the different areas within an installation. Environmental settings were developed in conjunction with installation experts in the fields of meteorology, geology, hydrology, and geochemistry.

22326 (PNL–10552) **Wildlife studies on the Hanford site: 1994 Highlights report.** Cadwell, L.L. (ed.). Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012477. Source: OSTI; NTIS; INIS; GPO Dep.

The purposes of the project are to monitor and report trends in wildlife populations; conduct surveys to identify, record, and map populations of threatened, endangered, and sensitive plant and animal species; and cooperate with Washington State and federal and private agencies to help ensure the protection afforded by law to native species and their habitats. Census data and results of surveys and special study topics are shared freely among cooperating agencies. Special studies are also conducted as needed to provide additional information that may be required to assess, protect, or manage wildlife resources at Hanford. This report describes highlights of wildlife studies on the Site in 1994. Redd counts of fall chinook salmon in the Hanford Reach suggest that harvest restrictions directed at protecting Snake River salmon may have helped Columbia River stocks as well. The 1994 count (5619) was nearly double that of 1993 and about 63% of the 1989 high of approximately 9000. A habitat map showing major vegetation and land use cover types for the Hanford Site was completed in 1993. During 1994, stochastic simulation was used to estimate shrub characteristics (height, density, and canopy cover) across the previously mapped Hanford landscape. The information provided will be available for use in determining habitat quality for sensitive wildlife species. Mapping Site locations of plant species of concern continued during 1994. Additional sensitive plant species data from surveys conducted by TNC were archived. The 10 nesting pairs of ferruginous hawks that used the Hanford Site in 1993 represented approximately 25% of the Washington State population.

22327 (PNL-SA–25951) **Heterogeneous surface fluxes and their effects on the SGP CART site.** Doran, J.C. (Pacific Northwest Lab., Richland, WA (United States)); Hu, Q.; Hubbe, J.M.; Liljegren, J.C.; Shaw, W.J.; Zhong, S.; Collatz, G.J. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503140–2: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95011495. Source: OSTI; NTIS; INIS; GPO Dep.

The treatment of subgrid-scale variations of surface properties and the resultant spatial variations of sensible and latent heat fluxes has received increasing attention in recent years. Mesoscale numerical simulations of highly idealized conditions, in which strong flux contrasts exist between adjacent surfaces, have shown that under some circumstances the secondary circulations induced by land-use differences can significantly affect the properties of the planetary boundary layer (PBL) and the region of the atmosphere above the PBL. At the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site, the fluxes from different land-surface types are not expected to differ as dramatically as those found in idealized simulations. Although the corresponding effects on the atmosphere should thus be less dramatic, they are still potentially important. From an ARM perspective, in tests of single column models (SCMs) it would be useful to understand the effects of the lower boundary conditions on model performance. We describe here our initial efforts to characterize the variable surface fluxes over the CART site and to assess their effects on the PBL that are important for the performance of SCMs.

22328 (SAND–94-2418C) **The environmental assessment of nuclear materials disposition options: A transportation perspective.** Wilson, R.K.; Clauss, D.B.; Moyer, J.W. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950936–1: Special meeting on the peaceful disposition of weapons-grade nuclear materials, Berlin (Germany), 3-9 Sep 1995). Order Number DE95011886. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has undertaken a program to evaluate and select options for the long-term storage and disposition of fissile materials declared surplus to defense needs as a result of the end of the Cold War. The transport of surplus fissile material will be an important and highly visible aspect of the environmental impact studies and other planning documents required for implementation of the disposition options. This report defines the roles and requirements for transportation of fissile materials in the program, and discusses an existing methodology for determining the environmental impact in terms of risk. While it will be some time before specific alternatives are chosen that will permit the completion of detailed risk calculations, the analytical models for performing the probabilistic risk assessments already exist with much of the supporting data related to the transportation system. This report summarizes the various types of data required and identifies sources for that data.

22329 (SAND–95-1007C) **An up-scaled, buoyant invasion percolation model for use in delineating subsurface DNAPL location.** Glass, R.J.; Webb, E.K.; Conrad, S.H. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950828–10: National heat transfer conference, Portland, OR (United States), 5-9 Aug 1995). Order Number DE95012528. Source: OSTI; NTIS; GPO Dep.

We introduce an up-scaled, buoyant invasion percolation model (UIP) for application to non-wetting, dense, non-aqueous phase liquid (DNAPL) migration at the geologic formation scale within the saturated zone of an aquifer. The UIP model incorporates a gravitational potential to model the displacement of fluids of different

densities and can be used for either LNAPLs (lighter than water) or DNAPLs (denser than water). We demonstrate model behavior in a simulated braided stream deposit. Simulations show the influence of textural changes across layers and gravity forces in controlling DNAPL migration. While our results are encouraging, the application of this up-scaled percolation model requires a series of tests both in the laboratory and in the field before judgment of sufficient validity for its intended purpose is achieved.

22330 (SFIM-AEC-ET-CR–95013) **Uptake of explosives from contaminated soil by existing vegetation at the Iowa Army Ammunition Plant.** Schneider, J.F. (Argonne National Lab., IL (United States)); Zellmer, S.D.; Tomczyk, N.A.; Rastorier, J.R.; Chen, D.; Banwart, W.L. Argonne National Lab., IL (United States); Army Environmental Center, Aberdeen Proving Ground, MD (United States). Feb 1995. 33p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. U.S.Army Environmental Center. Order Number DE95012998. Source: OSTI; NTIS; GPO Dep.

This study examines the uptake of explosives by existing vegetation growing in soils contaminated with 2,4,6-trinitrotoluene (TNT) and 1,3,5-trinitro-3,5-triazine (RDX) in three areas at the Iowa Army Ammunition Plant (IAAP). To determine explosives uptake under natural environmental conditions, existing plant materials and soil from the root zone were sampled at different locations in each area, and plant materials were separated by species. Standard methods were used to determine the concentrations of explosives, their derivatives, and metabolites in the soil samples. Plant materials were also analyzed. The compound TNT was not detected in the aboveground portion of plants, and vegetation growing on TNT-contaminated soils is not considered a health hazard. However, soil and plant roots may contain TNT degradation products that may be toxic; hence, their consumption is not advised. The compound RDX was found in the tops and roots of plants growing on RDX-contaminated soils at all surveyed sites. Although RDX is not a listed carcinogen, several of its potentially present degradation products are carcinogens. Therefore, the consumption of any plant tissues growing on RDX-contaminated sites should be considered a potential health hazard.

22331 (SLU-VNL-R–194) **Nitrogen flow in different cultivation systems. A field experiment at Lanna Research Station in south-west Sweden.** Haak, E.; Linden, B.; Persson, P.J. Swedish Univ. of Agricultural Sciences, Uppsala (Sweden). Dept. of Soil Sciences. 1994. 23p. (In Swedish). Order Number DE95779296. Source: OSTI; NTIS.

A long-term field experiment was started in 1979 at Lanna field experimental station, Skaraborg county, western Sweden, in order to study effects of crop rotation and nutrient management on the nitrogen flow in different cropping systems. The investigation comprised seven systems with two 6-year crop rotations, two with dairy farming, two with cash crops (one with high and one with low level of N-fertilization), one alternative/ecological, and two with spring barley mono cultures (one with application of pig slurry and mineral fertilizer-N and one with only mineral fertilizer-N). Each cropping system was connected to a separate drainage system, installed for collection and determination of the amounts of nitrate nitrogen leached with drainage water. Results are presented for two six-year crop rotations, 1979-84 and 1985-90, as regards crop and nitrogen yields and as regards nitrate-N losses by leaching. 12 refs, 7 tabs

22332 (UCRL-CR–119477) **Optimal groundwater remediation design: Methodologies and software for contaminated aquifers. Final report.** Dougherty, D.E. (Univ. of Vermont, Burlington, VT (United States). Research Center for Groundwater Remediation Design). Lawrence Livermore National Lab., CA (United States). 31 Oct 1994. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012476. Source: OSTI; NTIS; GPO Dep.

Report includes diskette designed to run on IBM PC or compatible equipment.

This document comprises the final report of work performed under sub-contract B-239648 between the Lawrence Livermore National Laboratory (LLNL) and the University of Vermont (UVM). This contract was subsidiary to one between LLNL and the U.S. Department of Energy (DOE). This project had the goal of developing tools and strategies regarding how and where and when to apply the environmental restoration (ER) technologies that are under development. The development of decision support software for advanced environmental remediation technologies is tentative; many of the ER technologies are poorly understood, the applicability of methods to new untested sites is questionable, the ability to predict the effects of alternative remediation designs is very limited, and there are a large number of uncertainties associated with processes and parameters (physical, chemical, and biological), contaminants (distribution and type), and sociopolitical environment. Nevertheless, the potential for significant savings by using optimal design methods and the need to make decisions regardless of uncertainties has made this project worthy. A stop-work order was received in September 1994. An additional upper limit of $15,000 was provided for project termination activities, including report preparation. One of four deliverables was completed and provided to LLNL. MODLP is a computational tool for use in groundwater remediation design. It is a FORTRAN program that incorporates the well known and widely used MODFLOW simulator to represent flow of water in a saturated natural porous medium. MODLP is designed to allow the user to create and solve optimization problems for hydraulic control in groundwater systems. Inasmuch as environmental restoration costs are very large, savings of on the order of ten percent represent significant amounts, and optimal design has been demonstrated to help produce savings larger than ten percent, these activities have an important role to play within DOE.

22333 (UCRL-ID–119659) **Lithogenic and cosmogenic tracers in catchment hydrology.** Nimz, G.J. Lawrence Livermore National Lab., CA (United States). Jan 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011523. Source: OSTI; NTIS; INIS; GPO Dep.

A variety of physical processes affect solute concentrations within catchment waters. The isotopic compositions of the solutes can indicate which processes have determined the observed concentrations. These processes together constitute the physical history of the water, which is one of the primary concerns in hydrology. Many groundwater solutes are derived as a result of interaction between the water and the rock and/or soil within the system. These are termed "lithogenic" solutes. The isotopic compositions of these solutes provide information regarding rock-water interactions. Many other solutes have their isotopic compositions determined both internally and externally to the catchment system. Important members of this group include solutes that have isotopic compositions produced by atomic particle interactions with other nuclides. The source of the atomic particles can be cosmic radiation (producing "cosmogenic" nuclides in the atmosphere and land surface), anthropogenic nuclear reactions (producing "thermonuclear" nuclides), or radioactive and fission decay of naturally-occurring elements, such as U and Th (producing "in-situ" lithogenic nuclides in the deep subsurface). Current language usage often combines all of the atomic particle-produced nuclides under the heading "cosmogenic nuclides", and for simplicity we will often follow that usage, although always clearly indicating which variety is being discussed. This paper addresses the processes that affect the lithogenic and cosmogenic solute compositions in groundwater, and how these compositions can therefore be used in integrative ways to understand the physical history of groundwater within a catchment system.

22334 (UCRL-JC–119435) **Site characterization criteria (DOE-STD-1022-94) for natural phenomena hazards at DOE sites.** Chen, J.C.; Ueng, T.S.; Boissonnade, A.C. Lawrence Livermore National Lab., CA (United States). Dec 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950740–37: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95011743. Source: OSTI; NTIS; INIS; GPO Dep.

This paper briefly summarizes requirements of site characterization for Natural Phenomena Hazards (NPH) at DOE sites. In order to comply with DOE Order 5480.28, site characterization criteria has been developed to provide site-specific information needed for development of NPH assessment criteria. Appropriate approaches

are outlined to ensure that the current state-of-the-art methodologies and procedures are used in the site characterization. General and detailed site characterization requirements are provided in the areas of meteorology, hydrology, geology, seismology and geotechnical studies.

22335 (WSRC-RP-94-927) **Final Report on Testing of Off-Gas Treatment Technologies for Abatement of Atmospheric Emissions of Chlorinated Volatile Organic Compounds.** Jarosch, T.R.; Haselow, J.S.; Rossabi, J.; Burdick, S.A.; Raymond, R.; Young, J.E.; Lombard, K.H. Westinghouse Savannah River Co., Aiken, SC (United States). 23 Jan 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060136. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to summarize the results of the program for off-gas treatment of atmospheric emissions of chlorinated volatile organic compounds (CVOCs), in particular trichloroethylene (TCE) and perchloroethylene (PCE). This program was funded through the Department of Energy Office of Technology Development's VOC's in Non-Arid Soils Integrated Demonstration (VNID). The off-gas treatment program was initiated after testing of in-situ air stripping with horizontal wells was completed (Looney et al., 1991). That successful test expectedly produced atmospheric emissions of CVOCs that were unabated. It was decided after that test that an off-gas treatment is an integral portion of remediation of CVOC contamination in groundwater and soil but also because several technologies were being developed across the United States to mitigate CVOC emissions. A single platform for testing off-gas treatment technologies would facilitate cost effective evaluation of the emerging technologies. Another motivation for the program is that many CVOCs will be regulated under the Clean Air Act Amendments of 1990 and are already regulated by many state regulatory programs. Additionally, compounds such as TCE and PCE are pervasive subsurface environmental contaminants, and, as a result, a small improvement in terms of abatement efficiency or cost will significantly reduce CVOC discharges to the environment as well as costs to United States government and industry.

22336 (WSRC-TR-92-355-Bk.1) **Hydrogeologic Setting of A/M Area: Framework for Groundwater Transport. Book 1.** Van Pelt, R.; Lewis, S.E.; Aadland, R.K. Westinghouse Savannah River Co., Aiken, SC (United States). 11 Mar 1994. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060117. Source: OSTI; NTIS; GPO Dep.

This document includes a brief summary of the regional geology within a 200-mile radius of the A/M Area, a summary of stratigraphy and hydrostratigraphic nomenclature as it applies to the A/M Area, and a summary of stratigraphy and hydrostratigraphy specific to the A/M Area. Five different stratigraphic cross sections show site-specific geology of the Tertiary section of the Upper Atlantic Coastal Plain geologic province within the A/M Area. The Cretaceous section lacks detail because the deepest wells penetrate only the uppermost part of the Upper Cretaceous sediments. Most of the wells are confined to the Tertiary section. The A/M Area is located in the northwestern corner of the Savannah River Site (SRS). The area serves as a main administrative hub for the site. Between 1958 and 1985, approximately 2,000,000 pounds of volatile organic solvents (metal degreasers, primarily trichloroethylene and tetrachloroethylene) were routed to the M Area Settling Basin. Between 1954 and 1958, effluent also was discharged to Tim's Branch via the A014 Outfall. In the main M Area Solvent Handling/Storage Area, a significant amount of leakage occurred from drums stored during this time period. Extensive quantities of solvents were transported, via the Process Sewer Line, to the M Area Settling Basin, and leaks occurred along this line as well. A smaller source area has been identified and is centered around the Savannah River Laboratory (SRL) (now called the Savannah River Technology Center [SRTC]) Complex. All of these source areas are represented by solvent contamination in the groundwater system. (Abstract Truncated)

22337 (WSRC-TR-92-355-Bk.6) **Hydrogeologic settings of A/M Area: Framework for groundwater transport: Book 6, Appendix B, Time/concentration graphs A/M Area monitoring wells.** Van Pelt, R.; Lewis, S.E.; Aadand, R.K. Westinghouse Savannah River Co., Aiken, SC (United States). 11 Mar 1994. 730p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95013964. Source: OSTI; NTIS; GPO Dep.

This document presents the time/concentration graphs for the Savannah River A/M monitoring wells. This Appendix B is part of the determination of the hydrogeologic setting of the A/M Area as a part of ground water transport studies.

22338 (WSRC-TR-94-0487-Vol.1) **F-Area Seepage Basins Groundwater Monitoring Report: Volume 1, Third and fourth quarters 1994.** Chase, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). Mar 1994. 488p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060128. Source: OSTI; NTIS; INIS; GPO Dep.

Isoconcentration/isoactivity maps included in this report indicate both the concentration/activity and extent of the primary contaminants in each of the three hydrostratigraphic units. Geologic cross sections indicate both the extent and depth of contamination of the primary contaminants in all of the hydrostratigraphic units during the second half of 1994. Water-level maps indicate that the groundwater flow rates and directions at the F-Area Seepage Basins have remained relatively constant since the basins ceased to be active in 1988.

22339 (WSRC-TR-94-0488) **H-Area Seepage Basins Groundwater Monitoring Report: Volume 1, Third and Fourth quarters 1994.** Chase, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). Mar 1994. 607p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060129. Source: OSTI; NTIS; INIS; GPO Dep.

Isoconcentration/isocactivity maps included in this report indicate both the concentration/activity and extent of the primary contaminants in each of the three hydrostratigraphic units during the second half of 1994. Geologic cross sections indicate both the extent and depth of contamination of the primary contaminants in all of the hydrostratigraphic units during the second half of 1994. Water-level maps indicate that the groundwater flow rates and directions at the H-Area Seepage Basins have remained relatively constant since the basins ceased to be active in 1988.

22340 (WSRC-TR-95-0118) **TNX Area 1994 Annual Groundwater Monitoring Report.** Chase, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). May 1995. 470p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060137. Source: OSTI; NTIS; INIS; GPO Dep.

During 1994, samples from selected wells of well cluster P 26 and the TBG, TNX, XSB, and YSB well series at the TNX Area were analyzed for selected heavy metals, indicator parameters, radionuclides, volatile organic compounds, and other constituents. Six parameters exceeded the final Primary Drinking Water Standards (PDWS). Nitrate and trichloroethylene exceeded the final PDWS most frequently. Five wells in this area currently are part of the Purge Water Containment Program due to high trichloroethylene concentrations. Carbon tetrachloride, gross alpha, nonvolatile beta, and tetrachloroethylene were elevated sporadically in one or more wells during the year. Groundwater flow directions and rates in the Unconfined Aquifer were similar from quarter to quarter during the year.

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Refer also to citation(s) 20979, 21346, 21351, 21363, 22191, 22238, 22259, 22275, 22279, 22295, 22296, 22304, 22307, 22311, 22465, 22483

22341 (ANL/CMT-ACL/VU-84890) **Determination of naturally-occurring actinides and their progeny in fresh water using inductively coupled plasma-mass spectrometry and batch separation.** Crain, J.S. (Argonne National Lab., IL (United States)); Yaeger, J.S.; Alvarado, J.A.; Smith, L.L.; Kiely, J.T.; Smith, F.G. Argonne National Lab., IL (United States). [1995]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950402-9-Vugraphs: 209.

American Chemical Society (ACS) national meeting, Anaheim, CA (United States), 2-6 Apr 1995). Order Number DE95011822. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this report is to show the use of ICP-MS in combination with appropriate preparative techniques for the determination of actinide elements in the environment. It examines and identifies the sample introduction and preparation techniques necessary to achieve required detection limits and mitigate interferences. This volume contains a set of viewgraphs.

22342 (CONF-9505215–1) **The advantages of including professionals from different fields of study in the solution of today's water-related problems.** Renshaw, A. Oak Ridge National Lab., TN (United States). 9 May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1995 American Society of Civil Engineers water resources and management conference; Boston, MA (United States); 7-10 May 1995. Order Number DE95013215. Source: OSTI; NTIS; GPO Dep.

This report presents the details of a meeting of the American Society of Civil Engineers pertaining to water resources and quality. This report suggests an interdisciplinary approach to solving today's problems dealing with water resources.

22343 (DOE/BP/00029–1) **Evaluation of water quality conditions near proposed fish production sites associated with the Yakima Fisheries Project. Final report.** Dauble, D.d.; Mueller, R.P.; Martinson, G.A. Pacific Northwest Lab., Richland, WA (United States). May 1994. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-93BP00029. Order Number DE95011451. Source: OSTI; NTIS; INIS; GPO Dep.

In 1991, the Pacific Northwest Laboratory (PNL) began studying water quality at several sites in the Yakima River Basin for the Bonneville Power Administration. These sites were being proposed as locations for fish culture facilities as part of the Yakima Fisheries Project (YFP). Surface water quality parameters near the proposed fish culture facilities are currently suitable for fish production. Water quality conditions in the mainstream Yakima River and its tributaries are generally excellent in the upper part of the watershed (i.e., near Cle Elum), but they are only fair to poor for the river downstream of Union Gap (river mile 107). Water quality of the Naches River near Oak Flats is also suitable for fish production. Groundwater supplies near the proposed fish production facilities typically have elevated concentrations of metals and dissolved gases. These conditions can be mitigated using best engineering practices such as precipitation and degasification. Additionally, mixing with surface water may improve these conditions. Depending on the location and depth of the well, groundwater temperatures may be warmer than optimum for acclimating and holding juvenile and adult fish. Water quality parameters measured in the Yakima River and tributaries sometimes exceed the range of values described as acceptable for culture of salmonids and for the protection of other aquatic life. However, constituent concentrations are within ranges that exist in many northwest fish hatcheries. Additionally, site-specific tests conducted by PNL (i.e., live box exposures and egg incubation studies) indicate that fish can be successfully reared in surface and well water near the proposed facility sites. Thus, there appear to be no constraints to artificial production for the YFP.

22344 (DOE/EA–1075) **Proposed Casey's Pond Improvement Project, Fermi National Accelerator Laboratory.** Department of Energy, Washington, DC (United States). Div. of Electric Energy Systems. May 1995. 56p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013827. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA), evaluating the impacts associated with the proposed Casey's Pond Improvement Project at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. The improvement project would maximize the efficiency of the Fermilab Industrial Cooling Water (ICW) distribution system, which removes (via evaporation) the thermal load from experimental and other support equipment supporting the high energy physics program at Fermilab. The project would eliminate the risk of overheating during fixed target experiments, ensure that the Illinois Water Quality Standards are consistently achieved and provide needed additional water storage for fire protection. Based on the analysis in the EA, the DOE has determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement is not required.

22345 (ETDE-DE–120) **Development of process combinations facilitating the commercial use of powdered active carbon in refined waste water purification through recycling of biologically regenerated, partially loaded active carbon. Final report.** Rott, U.; Menzel, U.; Detter, A. Stuttgart Univ. (Germany). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft. 15 Feb 1995. 177p. (In German). Sponsored by Bundesministerium fuer Bildung, Wissenschaft, Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMBF 02WA9107. Order Number DE95785544. Source: OSTI; NTIS (US Sales Only).

Processes for refined waste water purification combining adsorption, flocculation, and filtration can be optimised with regard to filter service life, filter charge rate and output quality by adding a sedimentation stage upstream the filter to enhance the deposition of active carbon. The overall result of solids deposition turns out to be better if the flocculation agents are added prior to sedimentation rather than after. Recirculating the partially loaded powdered active carbon in the biological section of the plant improves the output of the biological stage with regards to the parameters dyes, AOX and COD. Moreover, this greatly improves the settling behaviour of the activated sludge. In two-stage plants this latter effect is found to be greater if the partially loaded powdered active carbon is returned to the first stage rather than to the second biological stage of the plant. Thus the consumption of fresh powdered active carbon is reduced without affecting final output quality. (orig.)

22346 (GSF–39/93, pp. 282) **Experimental studies on increased carry-over of nitrogen in forest soils of the pre-Alpine region (Hoegiwald).** Kreutzer, K. (Lehrstuhl fuer Bodenkunde und Standortlehre der Ludwig-Maximilians-Universitaet Muenchen, Weihenstephan (Germany)); Koch, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/water chemistry; SOILS/nitrogen; SOILS/water chemistry; FORESTS; SOILS; NITROGEN; FEDERAL REPUBLIC OF GERMANY; SOIL CHEMISTRY; DEPOSITION; TERRESTRIAL ECOSYSTEMS; SPRUCES; AMMONIA

22347 (GSF–39/93, pp. 320-332) **Effects of nitrogen deposition on nitrate contents in the ground water of forested catchment areas of Bavaria.** Bittersohl, J. (Bayerisches Landesamt fuer Wasserwirtschaft, Muenchen (Germany)); Zahn, M.T.; Sager, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Due to permanent nitrate pollution of many agriculturally influenced groundwaters there is an urgent need of comparable data and facts about the development of nitrate contents under forests in order to manage drinking water resources. Evaluation for Bavaria

is based on new data from literature and own measurements of nitrogen deposition as well as concentration of nitrates in the deeper seepage zone, and at ground water catchment measuring points. These data show a mean nitrate concentration in the ground water of 10.5 mg/l which is wholly attributable to the influence of the forest. At individual sites mean concentrations were found to range from trace contents to between 20-30mg/l. With some exceptions, pollution levels are not alarming so far. With ongoing deposition of nitrogen, however, we have to expect increased nitrate concents in groundwater under forests. The nitrate problem may therefore considerably aggravate drinking water supply. (orig./EW).

22348 (GSF–39/93, pp. 333-343) **Factors influencing carry-over and carry-out of nitrogen in forest ecosystems, selected examples from sites in the Spessart, Fichtelgebirge and Munich gravel plains.** Krebs, M. (Bayerische Forstliche Versuchs- und Forschungsanstalt, Muenchen (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Case studies from the development project "Effects of acid rain and forest death on groundwater" were the basis of a discussion of the following factors influencing carry-over and carry-out of nitrogen in forest eco systems: 1. Comparison of nitrogen flow with water in a young spruce stand and one old spruce stand at sites in the Munich gravel plain and in the Fichtelgebirge showed that the lower rate of deposition and the higher nitrogen demand in young forests usually lead to lower nitrate pollution levels in the groundwater. Growing forest undergrowth in old stands and general nitrogen storage capacitities of the soil are both modifying factors. Contrary to the health young trees in the Munich gravel plains the young trees in the Fichtelgebirge show already clear evidence of nitrogen carry-out into seepage waters. The reason appears to lie in the high quantities of acid carried into the Fichtelgebirge which further degrade the naturally acid soils and damaged the trees. 2. After stormthrow events in the spruce stands in the Spessart and the Munich gravel plains there was first a rise of nitrate concentrations in seepage water which, after peaking in the first winter, slowly decreased over the years. Seasonal levels of nitrate contents is traced back to the influence of nitrogen absorption by soil vegetation and trees growing at the side of the stand during the vegetation period. (orig./EW).

22349 (INIS-mf–14543) **Studies applications through tracers techniques and effluent contaminants dispersing in Montevideo coastal waters and east beaches.** Suarez, R. (Direccion Nacional de Tecnologia Nuclear, Montevideo (Uruguay)); Dellepere, A.; Pintos, A.; Barreiro, M.; Odino, R.; Souto, B.; Badano, A.; Crosignani, L.; Moreno, S. Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear; Universidad de la Republica, Montevideo (Uruguay). Facultad de Ingenieria. [1995]. 16p. (In Spanish). Order Number DE95631062. Source: OSTI; NTIS (US Sales Only); INIS.

With the purpose to define or not the contamination influence in Montevideo coastal waters, uranine and tritium tracers were injected in outlet river. A higher grade of contamination was found in the Montevideo Bay, and several recommendations were given for the future.

22350 (INIS-PE–95-02) **Origin of the water drained by the tunnel Graton.** Plata B, A. (International Atomic Energy Agency, Vienna (Austria). Dept. of Research and Isotopes); Rojas M, R. Instituto Peruano de Energia Nuclear, Lima (Peru). Dec 1992. 20p. (In Spanish). Order Number DE95632317. Source: OSTI; NTIS (US Sales Only); INIS.

The research of the origin of the water drained by the Graton tunnel was attempted using isotope techniques. During the period of studies (April 1989-October 1992), four field work was executed to sample waters for chemistry, stable isotope and Tritium analysis, an to inject tracers and verify the possible infiltration from the Rimac and Blanco rivers to the tunnel. The results of the stable isotope analysis show that the water drained by the Graton tunnel comes from a basin around 300 meters above the average altitude of the basin where the Graton is located. The Tritium analysis show that the water is relatively modern. Using the model of total mixing, the residence times of the water drained at the km 0.5 and 2.5 are in the order to 45 years. The conductivities of the water of the tunnel is higher than the Rimac river ones because the influence of mine water. The chemical analysis of the water sampled at the downstream end of the tunnel, show that the conservative ions of the water kept almost constant during more than two years. The results of the work with artificial tracer show that there is no significant leakage from the Rimac and Blanco rivers to the Graton tunnel. So far, it can be concluded as a preliminary approach that the Graton tunnel drains relatively modern water originated in another basin. The hydrodynamics of the area of study seems to include a large storage on underground water in the system. The topography, geology and isotopic composition of the water samples, points to the upper Mantaro river basin as the possible source of part of the water drained by the Graton tunnel. (authors). 20 p. 2 figs., 7 ills., 4 tabs.

22351 (ORNL/ER–206/V1) **Final project report on arsenic biogeochemistry in the Clinch River and Watts Bar Reservoir: Volume 1, Main text. Environmental Restoration Program.** Ford, C.J.; Byrd, J.T.; Grebmeier, J.M.; Harris, R.A.; Moore, R.C.; Madix, S.E.; Newman, K.A.; Rash, C.D. Oak Ridge National Lab., TN (United States). Apr 1995. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012537. Source: OSTI; NTIS; GPO Dep.

This document reports on the study of arsenic contamination in the Clinch River/Watts Bar Reservoir (CR/WBR) system, downstream from the US Department of Energy's Oak Ridge Reservation (ORR). Arsenic is of particular interest and concern because it occurs commonly in coal-bearing rock and waste products, such as fly ash associated with the burning of coal; it is classified as a Class A carcinogen by the Environmental Protection Agency; and disposal of fly ash, both on and off the ORR, may have contaminated surface water and sediments in the Clinch River and Watts Bar Reservoir. Four main sites were sampled quarterly over a 3-year period. Sites investigated included lower Watts Bar Reservoir near Watts Bar Dam [Tennessee River kilometer (TRK) 849.6], the Kingston area [Clinch River kilometer (CRK) 1.6], Poplar Creek, and the McCoy Branch Embayment. Additional sites were investigated in the vicinity of these main stations to determine the distribution of contamination and to identify possible alternative or additional sources of arsenic.

22352 (SFIM-AEC-ET-CR–95014) **Plant uptake of explosives from contaminated soil at the Joliet Army Ammunition Plant.** Zellmer, S.D. (Argonne National Lab., IL (United States)); Schneider, J.F.; Tomczyk, N.A.; Banwart, W.L.; Chen, D. Argonne National Lab., IL (United States). Apr 1995. 66p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95011642. Source: OSTI; NTIS; GPO Dep.

Explosives and their degradation products may enter the animal and human food chains through plants grown on soils contaminated with explosives. Soil and plant samples were collected from the Group 61 area at the Joliet Army Ammunition Plant and analyzed to determine the extent to which 2,4,6-trinitrotoluene (TNT) and its degradation products are taken up by existing vegetation and crops growing on contaminated soils. Neither TNT nor its degradation products was detected in any of the aboveground plant organs of existing vegetation. Oat (Avena sativa L.) and perennial ryegrass (Lolium perenne L.) were planted on TNT-contaminated soils amended with three levels of chopped grass hay. Extractable TNT concentrations in hay-amended soils were monitored for almost 1 year. Crop establishment and growth improved with increased levels of hay amendment, but TNT uptake was not affected or detected in any aboveground crop organs. Evidence was found to indicate that soil manipulation and hay addition

may reduce extractable TNT concentration in soils, but the wide variations in TNT concentrations in these soils prevented development of conclusive evidence regarding reduction of extractable TNT concentrations. Results from this study suggest that vegetation grown on TNT-contaminated soils is not a major health concern because TNT and its degradation products were not detected in aboveground plant organs. However, low concentrations of TNT, 4-amino-2,6-dinitrotoluene, and 2-amino-4,6-dinitrotoluene were detected in or on some existing vegetation and crop roots. 21 refs., 10 figs., 26 tabs.

22353 (UCRL-JC--118909) **Cost-effective sampling of ground water monitoring wells.** Johnson, V.M. (Lawrence Livermore National Lab., CA (United States)); Ridley, M.N.; Tuckfield, R.C. Lawrence Livermore National Lab., CA (United States). Feb 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504134--6: HAZMACON '95: hazardous materials management conference and exhibition, San Jose, CA (United States), 4-6 Apr 1995). Order Number DE95012222. Source: OSTI; NTIS; GPO Dep.

Cost-Effective Sampling (CES) is a method for estimating the lowest-frequency (and, as a result, lowest-cost) sampling schedule for a given groundwater monitoring location which will still provide needed information for regulatory and remedial decision-making. Its initial development was motivated by the preponderance of sampling results showing little changes over time or failing below detection limits at Lawrence Livermore National Laboratory's (LLNL's) environmental restoration sites. The fact that many locations had never shown, or had ceased for some time to show, any detectable levels or changes in levels of contamination suggested that some of their 700+ groundwater monitoring wells were being sampled more often than necessary. Similar concerns were raised at the Savannah River Site (SRS), where some 10,000 samples are taken per year from 1500+ monitoring wells. The question facing both organizations has been how to reduce sampling costs while still satisfying both regulatory agencies and their own scientists and engineers that sufficient data will be collected for decision-making purposes. The first version of CES was implemented at LLNL's Livermore site in 1992 and approved by regulators under CERCLA. It is designed to statistically evaluate the sampling results to be able to recommend sampling schedules of groundwater monitoring locations for a common suite of volatile organic compounds, with the goal of reducing frequencies. The table below presents the sampling status of monitoring wells at LLNL's two restoration sites both before and after the application of CES.

22354 (VTT-PUB--208) **On-line measurement of oil contaminants in water by filter-based infrared analyzers.** Niemelae, P. (VTT Electronics, Oulu (Finland). Optoelectronics). Technical Research Centre of Finland, Espoo (Finland); Oulu Univ. (Finland). 1994. 116p. Order Number DE95779234. Source: OSTI; NTIS; INIS.

The properties of a dedicated infrared analyzer for on-line measurement of the oil content of water, the Oili analyzer, are evaluated theoretically and with laboratory measurements. The analyzer was originally developed for controlling the discharge of ballast and bilge water from oil tankers and more than 200 such instruments have now been supplied for that purpose, representing about 10 % of the total market. Some technical improvements are suggested, and the improved instrument is shown to be capable of measuring oil in water to an accuracy of +- 20 % down to a detection limit of +5-10 ppm in the presence of high concentrations of interfering components and under varying environmental conditions. This opens up new potential applications for the instrument, e.g. the monitoring of water discharges from oil and gas production platforms. The infrared analyzer responds only to the dispersed oil fraction, and if the dissolved fraction is of interest as well, the instrument must be equipped with a UV option, as suggested here.

22355 (WHC-SD-ER5480-ER--001-Rev.1) **Hanford facilities tracer study report (315 Water Treatment Facility). Revision 1.** Ambalam, T. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); ICF Kaiser Hanford Co., Richland, WA (United States). May 1995. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012799. Source: OSTI; NTIS; GPO Dep.

Reported are the results and findings of a tracer study to determine contact time for the disinfection process of 315 Water Treatment Facility at 300 Area. The study utilized fluoride as the tracer and contact times were determined for two flow rates. Interpolation of data and short circuiting effects are also discussed.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 21777

22356 (LBL--36332) **FASEB symposium papers overview.** Krauss, R.M. Lawrence Berkeley Lab., CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States);National Insts. of Health, Bethesda, MD (United States). DOE Contract AC03-76SF00098. G hl 18574. (CONF-9404251--2: Federation of Americal Societies for Experimental Biology (FASEB) symposium, Anaheim, CA (United States), 24-28 Apr 1994). Order Number DE95012358. Source: OSTI; NTIS; GPO Dep.

This document describes aspects of the FASAB Meeting that were of interest to the author.

22357 (SAND--95-0831C) **Minimizing phylogenetic number to find good evolutionary trees.** Goldberg, L.A. (Sandia National Labs., Albuquerque, NM (United States)); Goldberg, P.W.; Phillips, C.A.; Sweedyk, E.; Warnow, T. Sandia National Labs., Albuquerque, NM (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. NSF Contract CCR-9457800. (CONF-9507123--1: 1995 symposium on combinatorial pattern matching, Helsinki (Finland), 4-7 Jul 1995). Order Number DE95011893. Source: OSTI; NTIS; GPO Dep.

Inferring phylogenetic trees is a fundamental problem in computational-biology. We present a new objective criterion, the phylogenetic number, for evaluating evolutionary trees for species defined by biomolecular sequences or other qualitative characters. The phylogenetic number of a tree T is the maximum number of times that any given character state arises in T. By contrast, the classical parsimony criterion measures the total number of times that different character states arise in T. We consider the following related problems: finding the tree with minimum phylogenetic number, and computing the phylogenetic number of a given topology in which only the leaves are labeled by species. When the number of states is bounded (as is the case for biomolecular sequence characters), we can solve the second problem in polynomial time. We can also compute a fixed-topology 2-phylogeny (when one exists) for an arbitrary number of states. This algorithm can be used to further distinguish trees that are equal under parsimony. We also consider a number of other related problems.

5501 Behavioral Biology

Refer also to citation(s) 22326

5502 Biochemistry

Refer also to citation(s) 20563, 20964, 21080, 21655

22358 (CONF-9505220--1) **Drosophila GRAIL: An intelligent system for gene recognition in Drosophila DNA sequences.** Xu, Ying (Oak Ridge National Lab., TN (United States)); Einstein, J.R.; Uberbacher, E.C.; Helt, G.; Rubin, G. Oak Ridge National Lab., TN (United States); California Univ., Berkeley, CA (United States). Dept. of Molecular and Cell Biology. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. international Institute of Electrical and Electronic Engineers (IEEE) symposium on intelligence in neural and biological systems; Hendron, VA (United States); 23-25 May 1995. Order Number DE95013042. Source: OSTI; NTIS; GPO Dep.

An AI-based system for gene recognition in Drosophila DNA sequences was designed and implemented. The system consists of two main modules, one for coding exon recognition and one for

single gene model construction. The exon recognition module finds a coding exon by recognition of its splice junctions (or translation start) and coding potential. The core of this module is a set of neural networks which evaluate an exon candidate for the possibility of being a true coding exon using the "recognized" splice junction (or translation start) and coding signals. The recognition process consists of four steps: generation of an exon candidate pool, elimination of improbable candidates using heuristic rules, candidate evaluation by trained neural networks, and candidate cluster resolution and final exon prediction. The gene model construction module takes as input the clustered exon candidates and builds a "best" possible single gene model using an efficient dynamic programming algorithm. 129 Drosophila sequences consisting of 441 coding exons including 216358 coding bases were extructed from GenBank and used to build statistical matrices and to train the neural networks. On this training set the system recognized 97% of the coding messages and predicted only 5% false messages. Among the "correctly" predicted exons, 68% match the actual exon exactly and 96% have at least one edge predicted correctly. On an independent test set consisting of 30 Drosophila sequences, the system recognized 96% of the coding messages and predicted 7% false messages.

22359 (DOE/ER/14003–6) **Energetics and kinetics of anaerobic aromatic and fatty acid degradation. Progress report, November 1993–November 1994.** McInerney, M.J. Oklahoma Univ., Norman, OK (United States). Dept. of Botany and Microbiology. 6 Dec 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-89ER14003. Order Number DE95013068. Source: OSTI; NTIS; GPO Dep.

Factors influencing the rate and extent of benzoate degradation by the anaerobic syntrophic consortia were studied. Nonlinear regression analysis showed that the cause of the benzoate threshold was not a diminished benzoate degradation capacity. Analysis of cocultures with hydrogen users that differed in their hydrogen utilization capacities showed that the threshold did not depend on the kinetic properties of the syntrophic partner. These data support a thermodynamic explanation for the threshold, and exclude the possibility that a change in the affinity of the enzyme system due to acetate inhibition caused the threshold. Modeling studies showed that the threshold value could be predicted from the concentrations of the end products, assuming a critical Gibb's free energy value. This work shows that interspecies acetate transfer is important in controlling the extent of metabolism by syntrophic organisms.

22360 (LBL–36921) **Structural studies of bacterial transcriptional regulatory proteins by multidimensional heteronuclear NMR.** Volkman, B.F. California Univ., Berkeley, CA (United States). Dept. of Chemistry; Lawrence Berkeley Lab., CA (United States). Feb 1995. 195p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95011259. Source: OSTI; NTIS; GPO Dep.

Nuclear magnetic resonance spectroscopy was used to elucidate detailed structural information for peptide and protein molecules. A small peptide was designed and synthesized, and its three-dimensional structure was calculated using distance information derived from two-dimensional NMR measurements. The peptide was used to induce antibodies in mice, and the cross-reactivity of the antibodies with a related protein was analyzed with enzyme-linked immunosorbent assays. Two proteins which are involved in regulation of transcription in bacteria were also studied. The ferric uptake regulation (Fur) protein is a metal-dependent repressor which controls iron uptake in bacteria. Two- and three-dimensional NMR techniques, coupled with uniform and selective isotope labeling allowed the nearly complete assignment of the resonances of the metal-binding domain of the Fur protein. NTRC is a transcriptional enhancer binding protein whose N-terminal domain is a 'receiver domain' in the family of 'two-component' regulatory systems. Phosphorylation of the N-terminal domain of NTRC activates the initiation of transcription of aeries encoding proteins involved in nitrogen regulation. Three- and four-dimensional NMR spectroscopy methods have been used to complete the resonance assignments and determine the solution structure of the N-terminal receiver domain of the NTRC protein. Comparison of the solution structure of the NTRC receiver domain with the crystal structures of the homologous protein CheY reveals a very similar fold, with the only significant difference being the position of helix 4 relative to the rest of the protein. The determination of the structure of the NTRC receiver domain is the first step toward understanding a mechanism of signal transduction which is common to many bacterial regulatory systems.

22361 (ORNL/TM–12976) **Alignment of DNA and protein sequences containing frameshift errors.** Guan, X.; Uberbacher, E.C. Oak Ridge National Lab., TN (United States). Apr 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95010432. Source: OSTI; NTIS; GPO Dep.

Molecular sequences, like all experimental data, are subject to error. Many current DNA sequencing protocols have very significant error rates and often generate artifactual insertions and deletions of bases (indels) which corrupt the translation of sequences and compromise the detection of protein homologies. The impact of these errors on the utility of molecular sequence data is dependent on the analytic technique used to interpret the data. In the presence of frameshift errors, standard algorithms using six frame translation can miss important homologies because only sub-fragments of the correct translation are available in any given frame. We present a new algorithm which can detect and correct frameshift errors in DNA sequences during comparison of translated sequences with protein sequences in the databases. This algorithm can recognize homologous proteins sharing 30% identity even in the presence of a 7% frameshift error rate. Our algorithm uses dynamic programming, producing a guaranteed optimal alignment in the presence of frameshifts, and has a sensitivity equivalent to Smith-Waterman. The computational efficiency of the algorithm is O(nm) where n and m are the sizes of two sequences being compared. The algorithm does not rely on prior knowledge or heuristic rules and performs significantly better than any previously reported method.

22362 (UCRL-JC–120812) **A MEMS-based miniature DNA analysis system.** Northrup, M.A. (and others); Gonzalez, C.; Hadley, D. Lawrence Livermore National Lab., CA (United States). 25 Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506192–1: Transducers '95, Stockholm (Sweden), 25-29 Jun 1995). Order Number DE95013266. Source: OSTI; NTIS; GPO Dep.

We detail the design and development of a miniature thermal cycling instrument for performing the polymerase chain reaction (PCR) that uses microfabricated, silicon-based reaction chambers. The MEMS-based, battery-operated instrument shows significant improvements over commercial thermal cycling instrumentation. Several different biological systems have been amplified and verified with the miniature PCR instrument including the Human Immunodeficiency Virus; both cloned and genomic DNA templates of β globin; and the genetic disease, Cystic Fibrosis from human DNA. The miniaturization of a PCR thermal cycler is the initial module of a fully-integrated portable, low-power, rapid, and highly efficient bioanalytical instrument.

5503 Cytology

Refer also to citation(s) 22398

5504 Genetics

Refer also to citation(s) 22358, 22362, 22378, 22397, 22398, 22464, 22948

22363 (DOE/EA–0856) **Environmental assessment for construction and operation of a Human Genome Laboratory at Lawrence Berkeley Laboratory, Berkeley, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of NEPA Oversight. Dec 1994. 66p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012235. Source: OSTI; NTIS; GPO Dep.

Lawrence Berkeley Laboratory (LBL) proposes to construct and operate a new laboratory for consolidation of current and future activities of the Human Genome Center (HGC). This document addresses the potential direct, indirect, and cumulative environmental

and human-health effects from the proposed facility construction and operation. This document was prepared in accordance the National Environmental Policy Act of 1969 (United States Codes 42 USC 4321-4347) (NEPA) and the US Department of Energy's (DOE) Final Rule for NEPA Implementing Procedures [Code of Federal Regulations 10CFR 1021].

22364 (DOE/ER/61780–1) **Minitrack on data and knowledge base issues in genomics at the 27th Hawaii International Conference on system sciences.** Connecticut Univ., Storrs, CT (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER61780. (CONF-940136–Summ.: 27. Hawaii international conference on system sciences, Maui, HI (United States), 4-7 Jan 1994). Order Number DE95011299. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the proceedings from the Minitrack on Data and Knowledge Base Issues in Genomics at the 27th Hawaii International Conference on System Science, January 4 - 7, 1994. The minitrack was organized by Dong-Guk Shin (University of Connecticut) and Francois Rechenmann (INRIA, France). Support was jointly provided by the NSF, NIH and DOE. The minitrack included, after rigorous review, ten full papers and four extended abstracts in the following five different research subareas of genome informatics: data modeling and management, sequence analysis, graphical user interface, interoperation in a heterogenous computing environment, and system integration in a knowledge-based approach.

5505 Metabolism

Refer also to citation(s) 21080

5506 Medicine

Refer also to citation(s) 21622, 21697, 22269, 22913

22365 (INIS-RU–406, pp. 41) **Development of new methods of Radiotherapy of neoplasms using neutron beams of the reactors.** Tsyb, A.F. (Rossijskaya Akademiya Meditsinskikh Nauk, Meditsinskij Radiologicheskij Nauchnyj Tsentr, Moscow (Russian Federation)); Mardynskij, Yu.S.; Obaturov, G.M. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NEOPLASMS/neutron capture therapy; BIOLOGICAL RADIATION EFFECTS; EFFICIENCY; NEOPLASMS; PATIENTS

22366 (LA-UR–95-1325) **Monte Carlo investigations of elastic scattering spectroscopy applied to latex spheres used as tissue phantoms.** Boyer, J.; Mourant, J.R.; Bigio, I.J. Los Alamos National Lab., NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950226–44: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95012069. Source: OSTI; NTIS; GPO Dep.

An optical-fiber-coupled, elastic-scatter spectrometer has proven effective in discriminating between malignant and non-malignant tissue in the human bladder and gastrointestinal tract. The system injects broadband light into the tissue with an optical fiber and spectrally analyzes the returning light collected by an adjacent fiber. The collected photons have experienced multiple scattering events and therefore arrive at the analysis fiber after traveling varied paths.the diameter of the source fiber is comparable to its separation from the collection fiber. The diffusion model is inappropriate for this geometry; therefore, Monte Carlo simulations are used. In addition, the size of the scattering sites in tissue are expected to be of the same order as the excitation wavelengths, and Mie theory is expected to provide the best description of the scattering and extinction. The authors will present and compare the results of simulations and measurements of the elastic scatter signal for suspensions of latex spheres in hemoglobin solutions of varying concentrations.

22367 (LA-UR–95-1478) **Computational radiology and imaging with the MCNP Monte Carlo code.** Estes, G.P.; Taylor, W.M. Los Alamos National Lab., NM (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404262–1: 1. world congress on computational medicine, public health and biotechnology, Austin, TX (United States), 24-28 Apr 1994). Order Number DE95011995. Source: OSTI; NTIS; GPO Dep.

MCNP, a 3D coupled neutron/photon/electron Monte Carlo radiation transport code, is currently used in medical applications such as cancer radiation treatment planning, interpretation of diagnostic radiation images, and treatment beam optimization. This paper will discuss MCNP's current uses and capabilities, as well as envisioned improvements that would further enhance MCNP role in computational medicine. It will be demonstrated that the methodology exists to simulate medical images (e.g. SPECT). Techniques will be discussed that would enable the construction of 3D computational geometry models of individual patients for use in patient-specific studies that would improve the quality of care for patients.

22368 (LBL–36616) **Three dimensional nuclear magnetic resonance spectroscopic imaging of sodium ions using stochastic excitation and oscillating gradients.** Frederick, B.deB. (California Univ., Berkeley, CA (United States)). Lawrence Berkeley Lab., CA (United States); California Univ., Berkeley, CA (United States). Dec 1994. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012354. Source: OSTI; NTIS; INIS; GPO Dep.

Nuclear magnetic resonance (NMR) spectroscopic imaging of ^{23}Na holds promise as a non-invasive method of mapping Na^+ distributions, and for differentiating pools of Na^+ ions in biological tissues. However, due to NMR relaxation properties of ^{23}Na in vivo, a large fraction of Na^+ is not visible with conventional NMR imaging methods. An alternate imaging method, based on stochastic excitation and oscillating gradients, has been developed which is well adapted to measuring nuclei with short T_2. Contemporary NMR imaging techniques have dead times of up to several hundred microseconds between excitation and sampling, comparable to the shortest in vivo ^{23}Na T_2 values, causing significant signal loss. An imaging strategy based on stochastic excitation has been developed which greatly reduces experiment dead time by reducing peak radiofrequency (RF) excitation power and using a novel RF circuit to speed probe recovery. Continuously oscillating gradients are used to eliminate transient eddy currents. Stochastic ^1H and ^{23}Na spectroscopic imaging experiments have been performed on a small animal system with dead times as low as 25μs, permitting spectroscopic imaging with 100% visibility in vivo. As an additional benefit, the encoding time for a 32x32x32 spectroscopic image is under 30 seconds. The development and analysis of stochastic NMR imaging has been hampered by limitations of the existing phase demodulation reconstruction technique. Three dimensional imaging was impractical due to reconstruction time, and design and analysis of proposed experiments was limited by the mathematical intractability of the reconstruction method. A new reconstruction method for stochastic NMR based on Fourier interpolation has been formulated combining the advantage of a several hundredfold reduction in reconstruction time with a straightforward mathematical form.

22369 (NEDO-IT–9210) **Material design related investigation. Investigation on the bionic design.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 158p. (In Japanese). Order Number DE95786810. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The biomolecular characteristics were analyzed to establish the basic technology for the utilization of artificial joint, liver and muscle. The rise in functional grade of biomolecules themselves, and inter-biomolecular recognition and bonding rationally and teleologically generates living body's functions to form the structure and

drive the molecules. Energywise extremely advantageous, those functions serve to creatively produce the artificial internal organs and elucidate the function of biotissue, if the tissue and function of living body can be artificially restructured by utilizing the biomolecular mechanism to make the tissue self-proper. It is the concept of bionic desing research. Methodologically, the inter-bimolecular action is to be synthetically analyzed through bio/physicochemistry-based computer simulation. The artificial materials excelling in adaptability to the living body are to be developed by analyzing the mechanism for the biotissue. The molecules-driving function is also to be analyzed which is generated dy the high-grade bonding of muscular and other high biomolecules. 280 refs., 69 figs., 9 tabs.

22370 (NUREG–0940-Vol.14-No.1-Pt.2) **Enforcement actions: Significant actions resolved medical licensees. Quarterly progress report, January 1995–March 1995. Volume 14, No. 1, Part 2.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Enforcement. May 1995. 289p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (January-March 1995) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to medical licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

22371 (SAND–95-0747C) **An overview of weapons technologies used to improve US healthcare.** Fahrenholtz, J.; Kovarik, T.L. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506184–1: Society of Women Engineers national meeting, Boston, MA (United States), 27 Jun - 1 jul 1995). Order Number DE95011602. Source: OSTI; NTIS; INIS; GPO Dep.

At Sandia National Laboratories the Biomedical Engineering Program uses existing weapons-related technology in medical applications in order to reduce health care costs, improve diagnoses, and promote efficient health care delivery. This paper describes several projects which use Sandia technologies to solve biomedical problems. Specific technical capabilities that are important to this program include sensor data interpretation, robotics, lasers and optics, microelectronics, image processing and materials.

22372 (SAND–95-1123C) **Micro-telerobotic applications for microsurgery.** Ford, W.E. (Sandia National Labs., Albuquerque, NM (United States)); Morimoto, A.K.; Kozlowski, D.M.; Charles, S.T. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506178–2: International Association of Science and Technology for Development conference on robotics and manufacturing, Cancun (Mexico), 14-17 Jun 1995). Order Number DE95013018. Source: OSTI; NTIS; GPO Dep.

MicroDexterity Systems Inc. and Sandia National Laboratories are collaborating on the design of a six degree-of-freedom surgeon-controlled micropositioner and a six degree-of-freedom surgeon-controlled master for use in microsurgery. A control system will provide the linkage between the force-reflecting master and micropositioner for force scaling, position scaling, and tremor filtering. The technologies developed by this project are expected to enhance the skills of surgeons, improve the success rates for existing microsurgical procedures, make new high-dexterity procedures possible, and ultimately reduce surgical costs by increasing the precision and speed of operations. This paper discusses the motivation, approach, and accomplishments to date.

22373 (UCRL-JC–118744) **PEREGRINE: An all-particle Monte Carlo code for radiation therapy.** Hartmann Siantar, C.L.; Chandler, W.P.; Rathkopf, J.A.; Svatos, M.M.; White, R.M. Lawrence Livermore National Lab., CA (United States). Sep 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950420–24: International conference on mathematics and computations, reactor physics, and environmental analyses, Portland, OR (United States), 30 Apr - 4 may 1995). Order Number DE95012457. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of radiation therapy is to deliver a lethal dose to the tumor while minimizing the dose to normal tissues. To carry out this task, it is critical to calculate correctly the distribution of dose delivered. Monte Carlo transport methods have the potential to provide more accurate prediction of dose distributions than currently-used methods. PEREGRINE is a new Monte Carlo transport code developed at Lawrence Livermore National Laboratory for the specific purpose of modeling the effects of radiation therapy. PEREGRINE transports neutrons, photons, electrons, positrons, and heavy charged-particles, including protons, deuterons, tritons, helium-3, and alpha particles. This paper describes the PEREGRINE transport code and some preliminary results for clinically relevant materials and radiation sources.

5508 Morphology

Refer also to citation(s) 21677, 22369

5509 Pathology

22374 (UCRL-ID–116044) **Historical summary and recommendations on Melanoma in the LLNL workforce.** Moore, D.H. II; Hatch, F. Lawrence Livermore National Lab., CA (United States). Dec 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013288. Source: OSTI; NTIS; GPO Dep.

This document provides a historical summary and recommendations on melanoma in the Lawrence Livermore National Laboratory (LLNL) workforce. Melanoma of the skin comprises about 3.5% of the incidence (38,000 new cases in 1991) and 1.7% of the mortality (8500 deaths in 1991) of all cancer in the U.S. However, for several decades it has shown the fastest rate of increase of any cancer site. The following areas are discussed: background and recognition of increased melanoma at LLNL, history of melanoma studies at LLNL, results from occupational factors study, overall conclusion on increased melanoma incidence, and recommendations for future management.

5510 Physiological Systems

Refer also to citation(s) 22369

22375 (UCRL-JC–119789) **Mathematical analysis of errors resulting from choice of reference frame coordinates in measuring human joint motion.** Hollerbach, K. (Lawrence Livermore National Lab., CA (United States)); Hollister, A. Lawrence Livermore National Lab., CA (United States). Feb 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9507124–1: 15. Congress of the International Society of Biomechanics, Jyvaskyla (Finland), 2-6 Jul 1995). Order Number DE95010918. Source: OSTI; NTIS; GPO Dep.

Measurements of human joint motion frequently involve the use of opto-electronic and other motion analysis systems where some type of makers are used to establish joint motion within a global reference coordinate frame. Typically, this global reference coordinate frame is chosen to be most convenient for the person carrying out the experiment in which the joint motion is measured, and Euler angles are chosen as the measure of joint motion. Results, however, may be quite arbitrary and therefore rendered meaningless if the reference frame is not properly chosen with respect to the physical joint axis. In order to make a proper choice of coordinate axes in the reference frame, one must take into consideration both the location and the orientation of die physical joint axis relative to the reference frame's axes. In nature, joint axes can exist at any orientation and location relative to an arbitrarily chosen global reference frame. An axis that is not properly aligned with the global reference frame is therefore called an arbitrary axis. We demonstrate that errors result when measurements and calculations are

made in a global reference frame that is arbitrarily placed and oriented, with little regard for the physical axis. Slight offsets of global reference frame produce significant errors in recording rotations about the joint axis. We conclude that, in order to be able to reach valid conclusions from joint motion measurements, the reference frame with respect to which all are taken must be brought to the physical axis; furthermore, one of the reference axes must be aligned with the physical axis. Any other choice of reference axes will result in misleading an often erroneous results.

5520 Public Health

22376 (CONF-950168–Absts.) **The development and implementation of a geographic analysis system for population health and environmental risk assessment.** Medical Univ. of South Carolina, Charleston, SC (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-91SR18217. From 1995 CDC/ATSDR symposium on statistical methods: small area statistics in public health: design, analysis graphic and spatial methods; Atlanta, GA (United States); 25-26 Jan 1995. Order Number DE95013877. Source: OSTI; NTIS; GPO Dep.

Traditional approaches for the assessment of environmental exposure and health have employed data collection and analysis methods which are time-consuming and expensive as well as being limited to participation of subjects in selected geographic areas. As a component of an environmental risk assessment program, an alternate approach which utilizes a geographic information system has been initiated. The system utilizes a geo-coding process which enables the investigation and assessment of population data from the state level to the Census block level. This comprehensive system provides he capability of merging information from multiple data sources. For instance, cancer registry cases as well as other medical data bases involving cardiovascular, neurological, and immuno-suppressed conditions could be assessed as population indicators. These data can be analyzed with existing demographic and environmental exposure data. The pilot stud of the system incorporated cancer incidence cases to the block level. Complete ascertainment and quality control measures required a detailed, but manageable protocol. Such a system provides an efficient and timely data resource for environmental risk assessment. In addition, the system establishes a strong collaborative network amono investigators and government agencies.

22377 (LBL–36630-Rev.) **Use of density equalizing map projections (DEMP) in the analysis of childhood cancer in four California counties.** Merrill, D.W. Selvin, S.; Close, E.R.; Holmes, H.H. Lawrence Berkeley Lab., CA (United States). Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950168–1-Rev.: 1995 CDC/ATSDR symposium on statistical methods: small area statistics in public health: design, analysis graphic and spatial methods, Atlanta, GA (United States), 25-26 Jan 1995). Order Number DE95012388. Source: OSTI; NTIS; GPO Dep.

In studying geographic disease distributions, one normally compares rates of arbitrarily defined geographic subareas (e.g. census tracts), thereby sacrificing the geographic detail of the original data. The sparser the data, the larger the subareas must be in order to calculate stable rates. This dilemma is avoided with the technique of Density Equalizing Map Projections (DEMP). Boundaries of geographic subregions are adjusted to equalize population density over the entire study area. Case locations plotted on the transformed map should have a uniform distribution if the underlying disease rates are constant. The density equalized map portrays both individual cases and rates, and can be understood by untrained observers. Simple statistical techniques can be used to test the uniformity of the transformed map. This report describes application of the DEMP technique to a sizeable 'real-world' data set: 401 childhood cancer cases occurring between 1980 and 1988 in four California counties. In an earlier analysis of the same data, the California Department of Health Services (DHS) calculated rates for 101 communities and found no significant geographic variability. The DDS 1980–88 population estimates are no longer available, so in this analysis 1980 Census data were used; geographic units were 262 census tracts. A k'th nearest neighbor analysis, corrected for boundary effects and for within-tract variability, provides strong evidence for geographic nonuniformity in tract rates ($\rho < 10^{-4}$). No such effect is observed for artificial cases generated under the assumption of constant rates. Pending reanalysis with 1980-88 population estimates, no epidemiologic conclusions can be drawn at this time.

5530 Agriculture and Food Technology

Refer also to citation(s) 21065, 21072, 22432, 22434

22378 (DOE/ER/14004–T2) **The molecular characterization of the lignin-forming peroxidase. Progress summary report, April 1, 1992–March 31, 1995.** Lagrimini, L.M. Ohio State Univ., Columbus, OH (United States). Dept. of Horticulture. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14004. Order Number DE95012449. Source: OSTI; NTIS; GPO Dep.

My research program focuses entirely on the study of the lignin-forming peroxidase of tobacco. Ever since our cloning and sequencing of the first plant peroxidase cDNA, we have pioneered in the introduction of the tools of molecular biology to the study of plant peroxidases. A significant part of our effort has been focused on the construction and analysis of transgenic plants which either over- or under-express the tobacco anionic peroxidase. This research has not only supported the role for this enzyme in lignification, but has opened the door to our understanding of additional metabolic functions including auxin metabolism and insect defense. As you will learn, this enzyme's role in auxin catabolism has lead to numerous phenotypes in transgenic plants. More recently, our attention has been directed towards the analysis of peroxidase gene expression. From this work we have learned that the anionic peroxidase gene is expressed at high levels in the xylem-forming cells, epidermis, and trichomes. This expression pattern supports its role lignification and hose defenses. We have also learned that this gene is down-regulated by auxin which indicates a strong relationship between auxin and the anionic peroxidase. 12 figs.

22379 (IAEA-R–5146-F) **Isotopic (^{18}O,^{2}H) characterization and modelling of the spatial-time variability of water transfers at the vegetation blanket interface. Final report for the period December 1988 - December 1989.** Bariac, T. (Universite Pierre et Marie Curie, Paris (France). Lab. de Biogeochimie Isotopique). International Atomic Energy Agency, Vienna (Austria). 1989. 45p. (In French). Order Number DE95631108. Source: OSTI; NTIS (US Sales Only); INIS.

The main objectives of the study were: (1) analysis of the spatial (40m) evolution of the heavy isotopes content in foliar water without and with transpiration; (2) analysis of the climatic parameters influence on the content of heavy isotopes in foliar water; (3) analysis of relations between the isotopic composition of the foliar water and of the atmosphere vapors collected up to 100m high. Figs and tabs.

22380 (IC–95/67) **Analysis of a general age-dependent vaccination model for a vertically transmitted disease.** El Doma, M. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 20p. Order Number DE95633291. Source: OSTI; NTIS (US Sales Only); INIS.

A SIR epidemic model of a general age-dependent vaccination for a vertically as well as horizontally transmitted disease is investigated when the total population is time dependent, and fertility, mortality and removal rates depend on age. We establish the existence and the uniqueness of the solution and obtain the asymptotic behaviour for the solution. For the steady state solution a critical vaccination coverage which will eventually eradicate the disease is determined. (author). 18 refs.

22381 (IC–95/77) **Stability analysis of nonlinear integro-differential equations arising in age-dependent epidemic models.** El Doma, M. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 15p. Order Number DE95633292. Source: OSTI; NTIS (US Sales Only); INIS.

An age-structured epidemic model of an SI type that incorporate vertical transmission is investigated when the fertility and mortality rates depend on age. We determine the steady states and examine their stabilities. (author). 13 refs.

22382 (INIS-RU–406, pp. 14) **Radiation biological technologies of decontamination from conditionally pathogenic bacteria and salmonellas of fodder and products of poultry plant.** Rakitskaya, G. A.; Kaushanskij, D.A.; Samojlenko, I.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ANIMAL FEEDS/biological radiation effects; ANIMAL FEEDS/inactivation; EGGS/biological radiation effects; EGGS/inactivation; MEAT/biological radiation effects; MEAT/inactivation; INACTIVATION; EGGS; GAMMA RADIATION; MEAT; PATHOGENS; POWDERS; RADIATION DOSES; SALMONELLA

22383 (INIS-RU–406, pp. 15) **Experience of application and prospects of usage of combined radiation technologies.** Samojlenko, I.I.; Kaushanskij, D.A.; Rakitskij, G.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MEDICAL SUPPLIES/radiosterilization; INACTIVATION; MAGNETIC FIELDS; RADIOSTERILIZATION; RADIATION DOSES; SYNERGISM; VIRUSES

22384 (INIS-RU–406, pp. 16) **Application of radiation in pharmaceutical, biotechnological and food processing industries.** Trofimov, V.I.; Shishkina, N.S. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DRUGS/radiosterilization; FOOD/radiodisinfestation; FOOD/radiosterilization; BACTERIA; DRUGS; RADIOSTERILIZATION; EFFICIENCY; FOOD; RADIODISINFESTATION; VIRUSES

22385 (INIS-RU–406, pp. 30-31) **Experimental modification of short- and long-term effect of ionizing radiation on medications.** Gubchenko, P.P.; Voronina, T.A.; Molodavkin, G.M.; Kravchenko, E.V.; Kashtanova, V.V.; Pyatin, B.M.; Kozlovskij, Yu.B. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DRUGS/radiosterilization; CHEMICAL PROPERTIES; CORRELATION FUNCTIONS; DRUGS; RADIOSTERILIZATION; GAMMA RADIATION; PHYSICAL PROPERTIES; RADIATION DOSES; RESPONSE MODIFYING FACTORS

22386 (INIS-RU–406, pp. 51) **Radiation stimulation of formation in sea buckthorn.** Zhukov, O.S. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Genetiki i Selektsii Plodovykh Rastenij, Michurinsk (Russian Federation)); Mokrousova, G.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CROPS/stimulation; SEEDS/ionizing radiations; SEEDS/mutagens; CROPS; STIMULATION; RADIATION DOSES; SEEDS; MUTAGENS; SHRUBS

22387 (INIS-RU–406, pp. 52) **Study and usage of radiation mutants of tomatoes in selection.** Kozak, V.I. (Vsesoyuznyj Nauchno-Issledovanel'skij Inst. Rastenievodstva, Moscow (Russian Federation)). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. TOMATOES/radiation induced mutants; CHRONIC IRRADIATION; GAMMA RADIATION; PLANT BREEDING; TOMATOES

22388 (INIS-RU–406, pp. 58) **Application of radioactive waste of Kursk NPP reactors as a gamma radiation unit for radiostimulation of seeds in agricultural practice.** Ryakhin, V.M.; Gal'berg, V.P.; Ivanov, V.N.; Ryabtsev, G.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. AGRICULTURE; RADIOACTIVE WASTES/dose rates; SEEDS/stimulation; AGRICULTURE; CROPS; GAMMA SOURCES; GROWTH; KURSK-1 REACTOR; PLANTS; SEEDS; STIMULATION

22389 (INIS-RU–406, pp. 59) **Roentgenography method of determining latent injury of seeds and cereals.** Savin, V.N. (Vsesoyuznaya Akademiya Sel'skokhozyajstvennykh Nauk, Leningrad (Russian Federation). Agrofizicheskij Nauchno-Issledovatel'skij Inst.); Arkhipov, M.V.; Velikanov, L.P.; Kondrashova, M.D. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PLANT DISEASES/diagnosis; SEEDS/x-ray radiography; IRRADIATION PLANTS; DIAGNOSIS; SEEDS

22390 (INIS-RU–406, pp. 76) **Significance of radiation technology in diagnostics of bacterial infections.** Alimov, A.M.; Faizov, T.Kh.; Ravilov, A.Z. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. INFECTIOUS DISEASES/radioimmunoassay; DIAGNOSIS; RADIOIMMUNOASSAY; IODINE 125

22391 (INIS-RU–406, pp. 77) **Radioimmunological analysis for immunomonitoring in routine plague of pigs.** Yusupov, R.Kh.; Alimov, A.M.; Il'yasova, G.Kh.; Koksin, V.P. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. INFECTIOUS DISEASES/radioimmunoassay; ANTIGEN-ANTIBODY REACTIONS; RADIOIMMUNOASSAY; IODINE 125; SENSITIVITY; SWINE

22392 (INIS-RU–406, pp. 78) **Application of radioisotopes in studying genome of extremely dangerous infections stimulators.** Faizov, T.Kh.; Alimov, A.M.; Ravilov, A.Z. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. INFECTIOUS DISEASES/radioimmunoassay; ANIMALS; GENES; RADIOIMMUNOASSAY; LABELLED COMPOUNDS; MAN; PHOSPHORUS 32

22393 (INIS-RU–406, pp. 85) **Radioimmunological and radioisotope methods in cattle-breeding.** Ivanov, V.I. (Ivanovskij Sel'skokhozyajstvennyj Inst., Ivanovo (Russian Federation)). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. TRACER TECHNIQUES/animal breeding; TRACER TECHNIQUES/veterinary medicine; IODINE 125; REPRODUCTION; THYROID

22394 (INIS-RU–406, pp. 86) **Application of radioimmune methods in cattle-breeding.** Lebengarts, Ya.Z. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. COWS/reproduction; RADIOIMMUNOASSAY/animal breeding; BIOLOGICAL FUNCTIONS; CONCENTRATION RATIO; COWS; REPRODUCTION; EMBRYOS; HORMONES; MORTALITY; OVARIES; RADIOIMMUNOASSAY

22395 (INIS-RU–406) **All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.** RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Materials on using methods labelled atoms in animal and plant breeding also on usage of radiation mutants and their usage in selection, on development and usage of equipment for radionuclide removal from food chains were presented. New radioprotective compounds were assessed.

22396 (UCRL-ID–119073) **Feasibility study of a microwave radar system for agricultural inspection.** Okelo-Odongo, S. Lawrence Livermore National Lab., CA (United States). 3 Oct 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011514. Source: OSTI; NTIS; GPO Dep.

The feasibility of an impulse radar system for agricultural inspection is investigated. This system would be able to quickly determine the quality of foodstuffs that are passed through the system. A prototype was designed at the Lawrence Livermore National Laboratory and this report discusses it's evaluation. A variety of apples were used to test the system and preliminary data suggests that this technology holds promise for successful application on a large scale in food processing plants.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 20648, 20738, 20757, 20852, 20992, 20996, 21034, 21040, 21043, 21044, 21240, 21244, 21245, 21246, 21247, 21248, 21250, 21251, 21252, 21253, 21857, 21862, 22079, 22197, 22395

22397 (ANL/CMB/PP–84857) **Expression of cytoskeletal and matrix genes following exposure to ionizing radiation: Dose-rate effects and protein synthesis requirements.** Woloschak, G.E. (Argonne National Lab., IL (United States)); Felcher, P.; Chin-Mei Chang-Liu. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012218. Source: OSTI; NTIS; GPO Dep.

Experiments examined the effects of radiation dose-rate and protein synthesis inhibition expression of cytoskeletal and matrix elements in Syrian hamster embryo cells. Results demonstrated little effect of dose-rate for neutrons when comparing expression of α-tubulin and fibronectin genes. Cycloheximide repressed accumulation of α-tubulin-mRNA following exposure to high dose-rate neutrons or γ rays. Cycloheximide did not affect accumulation of actin mRNA. Cycloheximide abrogated induction of fibronectin-mRNA which occurred following exposure to γ rays and high dose-rate neutrons. These results suggest a role for labile proteins in the maintenance of α-tubulin and fibronectin mRNA accumulation following exposure to radiation. 24 refs., 3 tabs.

22398 (ANL/CMB/PP–85889) **HIV transcription is induced in dying cells.** Woloschak, G.E. (Argonne National Lab., IL (United States)); Chang-Liu, Chin-Mei; Schreck, S. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012211. Source: OSTI; NTIS; GPO Dep.

Using HeLa cells stably transfected with an HIV-LTR-CAT construct, we demonstrated a peak in CAT induction that occurs in viable (but not necessarily cell-division-competent) cells 24 h following exposure to some cell-killing agents. γ rays were the only cell-killing agent which did not induce HIV transcription; this can be attributed to the fact that γ-ray-induced apoptotic death requires functional p53, which is not present in HeLa cells. For all other agents, HIV-LTR induction was dose-dependent and correlated with the amount of cell killing that occurred in the culture. 14 refs., 4 figs., 1 tab.

22399 (ANL/EA/CP–83892) **Radiological dose assessment related to management of naturally occurring radioactive materials generated by the petroleum industry.** Smith, K.P. (Argonne National Lab., IL (United States). Environmental Assessment Div.); Blunt, D.L.; Williams, G.P.; Tebes, C.L. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950333–2: 2. SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment, Houston, TX (United States), 27-29 Mar 1995). Order Number DE95011960. Source: OSTI; NTIS; INIS; GPO Dep.

A preliminary radiological dose assessment related to equipment decontamination, subsurface disposal, landspreading, equipment smelting, and equipment burial was conducted to address concerns regarding the presence of naturally occurring radioactive materials in production waste streams. The assessment evaluated the relative dose of these activities and included a sensitivity analysis of certain input parameters. Future studies and potential policy actions are recommended.

22400 (BNL–61615) **Safety assessment and surveillance of decommissioning operations at DOE's nuclear facilities.** Cowgill, M.G. (Brookhaven National Lab., Upton, NY (United States)); Prochnow, D.; Worthington, P.R. Brookhaven National Lab., Upton, NY (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950216–147: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95013320. Source: OSTI; NTIS; INIS; GPO Dep.

A description is provided of a systematic approach currently being developed and deployed at the Department of Energy to obtain assurance that post-operational activities at nuclear facilities will be conducted in a safe manner. Using this approach, personnel will have available a formalized set of safety principles and associated question sets to assist them in the conducting of safety assessments and surveillance. Information gathered through this means will also be analyzed to determine if there are any generic complex-wide strengths or deficiencies associated with decommissioning activities and to which attention should be drawn.

22401 (CONF-9309110–Summ.) **[Malignant transformation of human fibroblasts by neutrons and by gamma radiation: Relationship to mutations induced].** Michigan State Univ., East

Lansing, MI (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER61625. From International symposium on molecular mechanisms of radiation and chemical carcinogen-induced cell transformation; Mackinac Island, MI (United States); 19-24 Sep 1993. Order Number DE95009803. Source: OSTI; NTIS; GPO Dep.

A brief overview if provided of selected reports presented at the International Symposium on Molecular Mechanisms of Radiation- and Chemical Carcinogen-Induced Cell Transformation held at Mackinac Island, Michigan on September 19-23, 1993.

22402 (DOE/ER/61009–T1) **Low dose neutron late effects: Cataractogenesis. Final progress report, April 1, 1992–March 31, 1993.** Worgul, B.V. Columbia Univ., New York, NY (United States). 1 Apr 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61009. Order Number DE95011919. Source: OSTI; NTIS; INIS; GPO Dep.

The work is formulated to resolve the uncertainty regarding the relative biological effectiveness (RBE) of low dose neutron radiation. The study exploits the fact that cataractogenesis is sensitive to the inverse dose-rate effect as has been observed with heavy ions and was an endpoint considered in the follow-up of the A-bomb survivors. The neutron radiations were initiated at the Radiological Research Accelerator facility (RARAF) of the Nevis Laboratory of Columbia University. Four week old ($\pm$ 1 day) rats were divided into eight dose groups each receiving single or fractionated total doses of 0.2, 1.0, 5.0 and 25.0 cGy of monoenergetic 435 keV neutrons. Special restraining jigs insured that the eye, at the midpoint of the lens, received the appropriate energy and dose with a relative error of $\pm$ 5%. The fractionation regimen consisted of four exposures, each administered at three hour ($\pm$ 1 minute) intervals. The neutron irradiated groups were compared to rats irradiated with 250 kVp X-rays in doses ranging from 0.5 to 7 Gy. The animals were examined on a biweekly basis utilizing conventional slit-lamp biomicroscopy and the Scheimpflug Slit Lamp Imaging System (Zeiss). The follow-ups, which proceeded for over 2 years, are now complete. This proved essential inasmuch as given the extremely low doses which were utilized, clinically detectable opacities were not anticipated until a significant fraction of the life span has lapsed. The results have exceeded all expectations.

22403 (IAEA-TECDOC–795, pp. 64-112) **Estimation of mean exposure in region CB.** Bucina, I.; Prouza, Z.; Mueller, H.; Malatova, I. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

Radiation exposure of people via the different pathways (external exposure from cloud and ground, internal exposure from inhalation and ingestion) has been an endpoint of the model calculation in scenario CB for which no direct measurements exist. However, some additional information has been made available which was given to the modelers in the CB scenario. Based on all information available at present, a best estimate of radiation exposure from ^{137}Cs in CB is given here. Due to the assessment tasks, this estimation considers the effective dose equivalent for adult persons (age 20 years at time of deposition), averaged over the whole region CB. Refs, figs and tabs.

22404 (IAEA-TECDOC–795, pp. 197-204) **Evaluation of HUMOD model's performance for CB scenario.** Hu Erbang (China Inst. for Radiation Protection, Taiyuan, Shanxi (China)); Liu Xingzeng; Zhang Heyuan. International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

HUMOD is a equilibrium compartmental model developed for CB scenario. Internal exposure due to inhalation and ingestion as well as the external exposure from the passing cloud and deposited ground activity are included. The main part of the model is for simulation of ingestion pathway. 5 figs, 2 tabs.

22405 (IAEA-TECDOC–795, pp. 213-222) **Evaluation of ENCONAN performance for CB exercise.** Kliment, V. (National Inst. of Public Health, Prague (Czech Republic)). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

ENCONAN (ENvironmental COntamination ANalysis) is a model of food chain contamination and of assessment of committed dose effective equivalent by inhalation and ingestion after an accident at nuclear facilities for cesium radioisotopes. 4 refs, 5 figs, 4 tabs.

22406 (IAEA-TECDOC–795, pp. 287-291) **HEDR - Comparison of model predictions with observations.** Napier, B.A. (Battelle Pacific Northwest Lab., Richland, WA (United States)). International Atomic Energy Agency, Vienna (Austria). Apr 1995. In *Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. Scenario CB. First report of the VAMP Multiple Pathways Assessment Working Group. Part of the IAEA/CEC Co-ordinated Research Programme on the Validation of Environmental Model Predictions (VAMP).* 334p. Order Number DE95633388. Source: OSTI; NTIS (US Sales Only); INIS.

HEDR model was developed to allow calculation of doses to people over a large area, resulting from releases of radionuclides over a long period of time. It is structured to allow concurrent calculation for many geographic areas, allowing for transfer of food products between areas.

22407 (INIS-BR–3506) **Lung inhomogeneity effect in the radiotherapy treatments using the BPW-34 photodiode detector.** Jesus Lopes Filho, F. de. Pernambuco Univ., Recife, PE (Brazil). Dept. de Energia Nuclear. Sep 1990. 71p. (In Portuguese). Order Number DE95631124. Source: OSTI; NTIS (US Sales Only); INIS.

PRONUCLEAR. Tese de Mestrado, 53.

The presence, in the radiation field, of regions with composition and/or differing from soft tissue may significantly affect the tumoral dose distribution in radiotherapy treatments. The effect of the lung on the dose distribution in the near by tissues was studied with high energy rays $c\gamma$ of ^{60} Co and 10 MV, 6 MV - X-ray and using a BPW-34 photodiode as a detector. The results obtained showed that the tumoral dose is reduced in the region anterior to the lung, due to backscattering reduction, whereas it is enhanced beyond the lung due to the lower attenuation in the inhomogeneity. (author). 36 refs, 11 figs, 12 tabs.

22408 (INIS-mf–14548) **SSDL Newsletter. No.32.** International Atomic Energy Agency, Vienna (Austria); World Health Organization, Geneva (Switzerland). Dec 1993. 27p. Order Number DE95633405. Source: OSTI; NTIS (US Sales Only); INIS.

The newsletter includes two articles presented at the consultants' meeting on 'External quality audit of the absorbed dose intercomparison method used by IAEA' held in Vienna between 20-22 December 1993. A separate abstract was prepared for each item. Refs, figs and tabs.

22409 (INIS-mf–14548, pp. 3-13) **Determination of calibration factors in terms of air kerma and absorbed dose to water in the ^{60}Co γ rays.** Boutillon, M. (Bureau International des Poids et Mesures (BIPM), 92 - Sevres (France)); Perroche, A.M. International Atomic Energy Agency, Vienna (Austria); World Health Organization, Geneva (Switzerland). Dec 1993. 27p. In *SSDL Newsletter. No.32.* Order Number DE95633405. Source: OSTI; NTIS (US Sales Only); INIS.

The method of calibration of an instrument, as performed at the BIPM in the ^{60}Co field in terms of air kerma or absorbed dose to water, is described in detail. The influence of various parameters which can affect the calibration factor is analyzed. The uncertainty is of order 0.3% and 0.5% for calibration factors in terms of air

kerma and of absorbed dose to water, respectively. (author). 14 refs, 10 figs, 3 tabs.

22410 (INIS-RU–406, pp. 17) **Protection of users of vide display terminals from electromagnetic radiation (analysis of radiation situation, recommendations on protection).** Trofimov, B.I.; Shishkina, N.S. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ELECTROMAGNETIC RADIATION/risk assessment; MICROCOMPUTERS/personnel monitoring; DISEASE INCIDENCE; HEALTH HAZARDS; MICROCOMPUTERS; PERSONNEL; PROGENY; REPRODUCTIVE DISORDERS

22411 (INIS-RU–406, pp. 20) **Effect of algin acid and its salts on the dynamics of strontium-85 and cesium-137 accumulation in rat organism.** Podkorytova, A.V. (Tikhookeanskij Nauchno-Issledovatel'skij Inst. Rybnogo Khozyajstva i Okeanografii, Vladivostok (Russian Federation)); Aminina, N.M.; Kovaleva, E.A.; Korzun, V.N. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MICE/buildup; ALGINATES; ALGINIC ACID; CESIUM 137; FOOD; INTERNAL IRRADIATION; METABOLISM; MICE; BUILDUP; ORAL ADMINISTRATION; RESPONSE MODIFYING FACTORS; SORPTION; STRONTIUM 85

22412 (INIS-RU–406, pp. 21) **Antiactinic efficiency of special meat products in case of internal irradiation of rats with strontium-90 and cesium-137.** Rudintseva, T.A.; Safronova, G.A.; Shevchenko, S.S.; Knizhnikov, V.A.; Shankala, N.K.; Komleva, V.S. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MEAT/radioprotective substances; BUILDUP; CESIUM 137; DIET; INTERNAL IRRADIATION; MEAT; METABOLISM; MICE; RADIATION DOSES; RADIOACTIVITY; RESPONSE MODIFYING FACTORS; STRONTIUM 90

22413 (INIS-RU–406, pp. 24) **New technology of treatment of radiation injuries (theoretical substantiation, experimental research, limitations and prospects).** Rozhdestvenskij, L.M. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BIOLOGICAL REPAIR/stimulation; RADIATION SYNDROME/post-irradiation therapy; STIMULATION; BONE MARROW CELLS; LABORATORY ANIMALS; STEM CELLS; TRANSPLANTS

22414 (INIS-RU–406, pp. 25) **Morphofunctional assessment of dimethpramide effect on the cells producing biogenic amines in case of acute intestinal radiation syndrome.** Alekseeva, I.I.; Legeza, V.I.; Pozharisskaya, T.D.; Shagoyan, M.G. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RADIATION SYNDROME/response modifying factors; RESPONSE MODIFYING FACTORS/amides; AMINES; BIOLOGICAL FUNCTIONS; CRYPT CELLS; DOGS; GAMMA RADIATION; GASTROINTESTINAL TRACT; MAST CELLS; MORPHOLOGICAL CHANGES; RADIATION DOSES; RATS; AMIDES; SYMPTOMS; TIME DEPENDENCE

22415 (INIS-RU–406, pp. 26) **Adaptogens of vegetative origin a possible method of preventing psychoemotional stress in case of operating with radioactive substances.** Astrov, V.V.; Antushevich, A.E. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DISEASE INCIDENCE/medicinal plants; RADIOISOTOPES/radiological personnel; RADIOLOGICAL PERSONNEL/disease incidence; MEDICAL SURVEILLANCE; MENTAL DISORDERS; RADIOISOTOPES; RESPONSE MODIFYING FACTORS

22416 (INIS-RU–406, pp. 27) **To the problem on radioprotective efficiency of chemical preparations.** Bojko, V.N. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHEMOTHERAPY/radioprotective substances; RADIOPROTECTIVE SUBSTANCES/biological radiation effects; CHEMOTHERAPY; FEMALES; GAMMA RADIATION; IMMUNITY; LETHAL IRRADIATION; MICE; RADIATION DOSES; SURVIVAL CURVES; TIME DEPENDENCE

22417 (INIS-RU–406, pp. 28) **Effect of thymogen, diethylstilberone and cystamine administration on the indexes of nonspecific resistivity.** Bojko, V.N. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RADIATION PROTECTION/biological radiation effects; RADIOSENSITIVITY/radioprotective substances; BIOLOGICAL FUNCTIONS; IONIZING RADIATIONS; LABORATORY ANIMALS; RADIOSENSITIVITY

22418 (INIS-RU–406, pp. 29) **Radioprotective and anticarcinogenic activity of glutapyrone under chronic irradiation of mice.** Bokk, M.I.; Egorov, A.E.; Ivanov, E.V.; Ponomareva, T.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHRONIC IRRADIATION/biological radiation effects; CHRONIC IRRADIATION/radioprotective substances; RADIOPROTECTIVE SUBSTANCES/carcinogenesis; GAMMA RADIATION; HALF-LIFE; LIFE SPAN; MICE; RADIATION DOSES; CARCINOGENESIS; SURVIVAL TIME

22419 (INIS-RU–406, pp. 32) **Cytogenetic study of radioprotective effect of compounds of various chemical closes.** Zhakovko, E.B.; Krasil'nikov, I.I.; Deev, S.P. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of*

radiobiology. Exhibition Radiobiology for practice. Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ORGANIC COMPOUNDS/radioprotective substances; SUBLETHAL IRRADIATION/chromosomal aberrations; SUBLETHAL IRRADIATION/radiation protection; BONE MARROW CELLS; GAMMA RADIATION; RATS; WHOLE-BODY IRRADIATION

22420 (INIS-RU–406, pp. 33) **Experimental substantiation of application of perfluorane in case of combined radiation injuries complicated by hemorrhage shock.** Ivanchenko, A.V.; Yurkevich, Yu.V.; Sinchuk, V.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BLOOD SUBSTITUTES/biological radiation effects; DOGS/gamma radiation; DOGS/hemorrhage; ANOXIA; BIOLOGICAL SHOCK; DOGS; HEMORRHAGE; RESPONSE MODIFYING FACTORS

22421 (INIS-RU–406, pp. 34) **Modifying effect of radioprotective substances of B-lymphocytes dynamics in mice spleen under irradiation.** Lebedev, S.N.; Morozova, I.N.; Deev, S.P.; Antushevich, A.E. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LYMPHOCYTES/biological radiation effects; LYMPHOCYTES/response modifying factors; RADIOPROTECTIVE SUBSTANCES/lymphocytes; BIOLOGICAL FUNCTIONS; IMMUNITY; LYMPHOCYTES; MICE; RADIATION DOSES; SPLEEN; TIME DEPENDENCE

22422 (INIS-RU–406, pp. 35) **Selection of risk groups of diseases on the contaminated areas using a new express method-test of P-protein determination in human blood serum.** Margulis, G.U. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Sel'skokhozyajstvennyj Biotekhnologii RASKhN, Moscow (Russian Federation)); Bartova, L.M.; Oganyan, R.R.; Karlina, L.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HUMAN POPULATIONS/health hazards; REACTOR ACCIDENTS/risk assessment; BLOOD SERUM; CHERNOBYLSK-4 REACTOR; CONTAMINATION; DISEASE INCIDENCE; PROTEINS; RADIOACTIVITY

22423 (INIS-RU–406, pp. 37) **Effect of chitosane of migration, proliferation and differentiation of stem cells and system of cyclic nucleotides.** Nikitin, V.Yu. (Voenno-Meditsinskaya Akademiya, Leningrad (Russian Federation)). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BLOOD FORMATION/lethal irradiation; CHITIN/stem cells; STEM CELLS/biological repair; STEM CELLS/cell proliferation; BONE MARROW; CHITIN; DRUGS; LIVER; MICE; RADIATION DOSES; RATS; SPLEEN; THYMUS; TIME DEPENDENCE

22424 (INIS-RU–406, pp. 38) **Application of vitamins and antioxidants for decreasing mutation frequency induced by gamma radiation.** Podlutskij, A.Ya. (RAN, Pushchino-na-Oke (Russian Federation). Inst. Teoreticheskoj i Ehksperimental'noj Biofiziki); Gaziev, A.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. GENE MUTATIONS/radioprotective substances; RADIOPROTECTIVE SUBSTANCES/antioxidants; RADIOPROTECTIVE SUBSTANCES/vitamins; AGE DEPENDENCE; DOSE-RESPONSE RELATIONSHIPS; GAMMA RADIATION; LYMPHOCYTES; MICE; RADIATION DOSES; RADIATION PROTECTION; ANTIOXIDANTS; VITAMINS; SPLEEN

22425 (INIS-RU–406, pp. 39) **New effective radioprotective compounds derivatives of sulfur-containing protective substances.** Sverdlov, A.G. (RAN, Sankt-Peterburg (Russian Federation). Inst. Yadernoj Fiziki); Grachev, S.A.; Kropachev, E.V.; Drobchenko, S.N.; Niranrova, N.G.; Timoshenko, S.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ORGANIC SULFUR COMPOUNDS/radioprotective substances; AMINES; LABORATORY ANIMALS; ORGANIC PHOSPHORUS COMPOUNDS; RADIATION PROTECTION; TOXICITY

22426 (INIS-RU–406, pp. 40) **State of superspiral DNA of lymphocytes and immunity indices of people following 5 years after the actione of factors of radiation accident.** Smirnov, V.S. (Voenno-Meditsinskaya Akademiya, Sankt-Peterburg (Russian Federation)); Dulatova, N.Kh. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LYMPHOCYTES/delayed radiation effects; REACTOR ACCIDENTS/immunity; CHERNOBYLSK-4 REACTOR; DNA; LYMPHOCYTES; MEDICAL SURVEILLANCE; MEN; RADIATION DOSES; IMMUNITY

22427 (INIS-RU–406, pp. 42) **Effect of detoxication on the state of liver of irradiated animals.** Chigareva, N.G.; Legeza, V.I.; Abdel', Yu.A.; Myasoedov, A.F.; Petkevich, N.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LIVER/early radiation effects; LIVER/post-irradiation therapy; BIOLOGICAL FUNCTIONS; BIOLOGICAL HALF-LIFE; DRUGS; ENZYME ACTIVITY; GAMMA RADIATION; LIPIDS; LIVER; MALES; OXIDATION; RADIATION SYNDROME; RATS; TIME DEPENDENCE

22428 (INIS-RU–406, pp. 43) **Efficiency of curative effect of plasmaphoresis at early terms of acute radiation syndrome.** Chigareva, N.G.; Legeza, V.I.; Abdul', Yu.A.; Androkhina, V.I.; Artemenko, A.G. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RADIATION SYNDROME/post-irradiation therapy; BLOOD COUNT; DOGS; EARLY RADIATION EFFECTS; GAMMA RADIATION; HISTAMINE; SURVIVAL CURVES; TIME DEPENDENCE

22429 (INIS-RU–406, pp. 44) **Effect of interleukine-1 on the recovery of wounds in case of combined radiation injury.** Yurkevich, Yu.V.; Sinchuk, V.I.; Pozharisskaya, T.D.; Vorob'ev, A.V.; Prokop'ev, A.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RATS/lethal irradiation; RATS/wounds; WOUNDS/biological repair; WOUNDS/post-irradiation therapy; DRUGS; IMMUNITY; MALES; PATHOLOGICAL CHANGES; RATS; WOUNDS; SKIN

22430 (INIS-RU–406, pp. 45) **Synergetic effect of ionizing radiation and microdements on the seeds of spring wheat.** Kostin, V.I. (Ul'yanovskij Sel'skokhozyajstvennyj Inst., Ul'yanovsk (Russian Federation)); Cherkasova, S.N. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. SEEDS/ionizing radiations; SYNERGISM/biological effects; BIOCHEMISTRY; COPPER SULFATES; CROPS; MANGANESE SULFATES; SEEDS; SYNERGISM; TRACE AMOUNTS; WHEAT; ZINC SULFATES

22431 (INIS-RU–406, pp. 46) **Effect of ionizing radiation and microelements on hardness of winter wheat.** Kostin, V.I. (Ul'yanovskij Sel'skokhozyajstvennyj Inst., Ul'yanovsk (Russian Federation)); Levanov, A.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. SEEDS/gamma radiation; SEEDS/trace amounts; WHEAT/stability; ELEMENTS; RADIATION DOSES; SEEDS; SURVIVAL TIME; WHEAT; STABILITY

22432 (INIS-RU–406, pp. 47) **Laser modification of ionizing radiation effect for the aims of selection.** Budagovskij, A.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Genetiki i Selektsii Plodovykh Rastenij, Michurinsk (Russian Federation)); Mokrousova, G.I.; Gudi, G.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LASER RADIATION/response modifying factors; RESPONSE MODIFYING FACTORS/biological repair; BIOLOGICAL FUNCTIONS; DOSE-RESPONSE RELATIONSHIPS; IONIZING RADIATIONS; LETHAL MUTATIONS; PLANT BREEDING; PLANTS; SEEDS

22433 (INIS-RU–406, pp. 49) **Forestry methods in technology of decreasing of radionuclide transfer on populated and agricultural areas.** Bykov, A.V.; Lysikov, A.B.; Melankholin, P.N. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CONTAMINATION/radioecological concentration; FORESTRY/remedial action; FORESTS/contamination; FORESTS/delayed radiation effects; CHERNOBYLSK-4 REACTOR; CONTAMINATION; DOSE RATES; FALLOUT; FOREST LITTER; FORESTRY; FORESTS; GROUND COVER; LAND USE; RADIOACTIVITY; REACTOR ACCIDENTS; SOILS

22434 (INIS-RU–406, pp. 53) **Best radiomutants of tomato by biochemical features and their investigation in selection.** Korchemnaya, N.A. (VNII Rastenievodstva, Moscow (Russian Federation)). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. TOMATOES/radiation induced mutants; BIOCHEMISTRY; CROPS; GAMMA RADIATION; HYBRIDIZATION; PLANT BREEDING; TOMATOES

22435 (INIS-RU–406, pp. 54) **Preparation of mutants of Gracila-ridal.** Kulepanov, V.N. (Dal'nevostochnyj Gosudarstvennyj Univ., Vladivostok (Russian Federation)); Ivanovskij, Yu.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ALGAE/auxins; ALGAE/gamma radiation; RADIATION INDUCED MUTANTS/plant breeding; ALGAE; AUXINS; RADIATION DOSES; REPRODUCTIVE DISORDERS

22436 (INIS-RU–406, pp. 55) **Protective effect of ammonium cation on development of radiation injury in plants.** Kurganova, L.N. (Gor'kovskij Gosudarstvennyj Univ., Gorki (Russian Federation)). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PEAS/radiation injuries; RADIATION INJURIES/ammonium compounds; BIOLOGICAL RECOVERY; CARBOXYLIC ACIDS; CELL MEMBRANES; CHLOROPLASTS; LIPIDS; PEAS; PHOTOSYNTHESIS; RADIATION DOSES; RADIATION PROTECTION; SEEDS

22437 (INIS-RU–406, pp. 60) **First gamma field in Russia: results, problem and prospects of investigation.** Vilenskij, E.R. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PLANTS/chronic irradiation; BIOLOGICAL RADIATION EFFECTS; DOSE RATES; GAMMA RADIATION; IRRADIATION PLANTS; ONTOGENESIS; PLANTS; RADIOSENSITIVITY

22438 (INIS-RU–406, pp. 63) **Unit for milk decontamination using tseolite.** Donskaya, G.A.; Mar'in, V.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHERNOBYLSK-4 REACTOR/reactor accidents; MILK/decontamination; MILK/zeolites; CESIUM ISOTOPES; CONTAMINATION; EFFICIENCY; ION EXCHANGE; MILK; DECONTAMINATION; ZEOLITES; PILOT PLANTS; RADIOACTIVITY; SPECIFICATIONS

22439 (INIS-RU–406, pp. 65-66) **Biological effect of ferrocyanides and their adsorbability in laboratory and industrial**

tests. Mayakov, E.N.; Budarkov, V.A.; Torubarova, A.A.; Volosevich, L.A.; Mishin, A.M.; Yastrebkov, Yu.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CESIUM ISOTOPES/food chains; FERROCYANIDES/biological effects; ADSORBENTS; CHERNOBYLSK-4 REACTOR; COWS; FERROCYANIDES; MEAT; MILK; POTASSIUM COMPOUNDS; RADIOISOTOPES; RADIONUCLIDE MIGRATION; REACTOR ACCIDENTS; SHEEP; TOXICITY

22440 (INIS-RU–406, pp. 67) **Antiactinic properties of mineralogic substate.** Surgucheva, L.M.; Makarov, N.V.; Budarkov, V.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RADIATION INJURIES/radioprotective substances; RADIOPROTECTIVE SUBSTANCES/substrates; AMINO ACIDS; BLOOD FORMATION; ELEMENTS; ENZYMES; GAMMA RADIATION; HORMONES; LIFE SPAN; MICE; RADIATION DOSES; RADIATION PROTECTION; SUBSTRATES; SURVIVAL TIME; TIME DEPENDENCE; TRACE AMOUNTS

22441 (INIS-RU–406, pp. 68) **Application of test of endogeneous spleen colony formation for selection of antiactinic preparations.** Surgucheva, L.M.; Budarkov, V.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RADIOPROTECTIVE SUBSTANCES/cfu; BIOLOGICAL RADIATION EFFECTS; GAMMA RADIATION; IMMUNITY; MICE; RADIATION DOSES; CFU

22442 (INIS-RU–406, pp. 69) **Application low dose irradiation for increase of chicken productivity.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Pak, V.V.; Kaushanskij, D.A.; Kusurova, Z.G. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHICKENS/low dose irradiation; CHICKENS/reproduction; REPRODUCTION/stimulation; BLOOD FORMATION; CHICKENS; REPRODUCTION; EGGS; GAMMA RADIATION; PROGENY; RADIATION DOSES; STIMULATION; X RADIATION

22443 (INIS-RU–406, pp. 70) **Methods of radiation biotechnology in turkey breeding.** Pokrovskij, B.S. (Kazanskij Veterinarnyj Inst., Kazan (Russian Federation)); Kirshin, V.A. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. FOWL/mass rearing; LOW DOSE IRRADIATION/progeny; BIOLOGICAL FUNCTIONS; EGGS; EMBRYOS; ENDOCRINE GLANDS; FOWL; GAMMA RADIATION; PROGENY; MORTALITY

22444 (INIS-RU–406, pp. 71) **Functional state of thyroid of chicken in case of X-irradiation of eggs.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Kusurova, Z.G.; Rogozhina, L.V.; Ukolova, Yu.M. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. EGGS/x radiation; THYROID/biological functions; BLOOD SERUM; CHICKENS; EGGS; HORMONES; RADIATION DOSES; RADIOIMMUNOASSAY; THYROID; TIME DEPENDENCE

22445 (INIS-RU–406, pp. 72) **Application of various immunodulators for increasing natural resistance of calves in conditions of the contaminated areas.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Lysenko, N.P.; Lebedev, E.A.; Evseev, N.D.; Levsha, P.A.; Topuriya, G.M.; Saulin, V.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHERNOBYLSK-4 REACTOR/reactor accidents; IMMUNOTHERAPY/radiosensitivity; BIOCHEMISTRY; CALVES; CESIUM 134; CESIUM 137; CONTAMINATION; DISEASE INCIDENCE; GASTROINTESTINAL TRACT; IMMUNITY; IMMUNOTHERAPY; RADIOSENSITIVITY; RADIOACTIVITY

22446 (INIS-RU–406, pp. 73) **Laboratory diagnostics and specific preventive measures of viral respiratory and intestinal infections of the cattle by monovalent and associated viral and bacterial preparations in the contaminated areas.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Syurin, V.N.; Murav'ev, V.N.; Khalenev, G.A.; Lysenko, N.P. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CONTAMINATION/animal breeding; CONTAMINATION/vaccines; INFECTIOUS DISEASES/diagnosis; BLOOD SERUM; CATTLE; CONTAMINATION; VACCINES; DISEASE INCIDENCE; DIAGNOSIS; POST-IRRADIATION THERAPY; RADIOISOTOPES; VIRUSES

22447 (INIS-RU–406, pp. 74) **Hormonal indices in cows with radionuclide injuries of the thyroid.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Lysenko, N.P.; Il'yazov, R.G.; Shchukin, M.V.; Sharlaj, E.V.; Boruk, O.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HORMONES/biological radiation effects; REACTOR ACCIDENTS/radiation doses; CHERNOBYLSK-4 REACTOR; CONCENTRATION RATIO; CONTAMINATION; COWS; HORMONES; THYROID

22448 (INIS-RU–406, pp. 75) **Effects of fatty-solvent vitamins on some hormonal indices of the cattle kept on the contaminated areas.** Belov, A.D. (Moskovskaya Veterinarnaya Akademiya, Moscow (Russian Federation)); Lysenko, N.P.; Fomicheva, N.A.; Chetverikova, O.P. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr

1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BLOOD SERUM/vitamins; CONTAMINATION/cattle; VITAMINS; CHERNOBYLSK-4 REACTOR; CONTAMINATION; CATTLE; HORMONES; REACTOR ACCIDENTS

22449 (INIS-RU–406, pp. 79) **Effect of vitamins A and C on the survival rate and indices of peripheral blood in immunized pigs on the background of gamma-irradiation.** Shashkarov, V.P.; Troshin, E.I. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. SWINE/gamma radiation; SWINE/vaccines; VITAMINS/blood formation; VITAMINS/survival curves; BIOLOGICAL RADIATION EFFECTS; IMMUNITY; RADIATION DOSES; SWINE; VACCINES; VITAMINS

22450 (INIS-RU–406, pp. 80) **Protective effect of nonspecific biostimulators on the animals organisms subjected to ionizing radiation.** Faizov, T.Kh.; Khazipov, N.Z. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. GUINEA PIGS/lethal radiation dose; SURVIVAL CURVES/response modifying factors; SURVIVAL CURVES/viruses; GAMMA RADIATION; RABBITS; VIRUSES

22451 (INIS-RU–406, pp. 81) **Physico-technological qualities of sheep skin following external gamma low dose irradiation of lambs.** Kurbangaleev, Ya.M. (Nauchno-Issledovatel'skij Veterenarnyj Inst., Kazan' (Russian Federation)); Ishmukhametov, K.T. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LOW DOSE IRRADIATION/productivity; SHEEP/low dose irradiation; ANIMAL BREEDING; GAMMA RADIATION; LIFE SPAN; PRODUCTIVITY; MEAT; SHEEP; SKIN

22452 (INIS-RU–406, pp. 82) **Change of respiration parameters in animals in case of radiation injuries.** Portnov, V.S. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RESPIRATORY SYSTEM/biological functions; RESPIRATORY SYSTEM/biological radiation effects; GAMMA RADIATION; LETHAL RADIATION DOSE; SHEEP; SPECTROSCOPY; TIME DEPENDENCE

22453 (INIS-RU–406, pp. 83) **Biological assessment of meat of the irradiated sheep.** Portnov, V.S.; Sivokhin, P.A.; Safonova, V.Yu.; Barkov, A.V. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MEAT/safety; SHEEP/lethal irradiation; GAMMA RADIATION; MEAT; SAFETY; RADIATION SYNDROME; SHEEP

22454 (INIS-RU–406, pp. 84) **Realization of immunological model of genesis of postradiation reactions.** Kirshin, V.A. (Moskovskaya Gosudarstvennaya Akademiya Prikladnoj Biotekhnologii, Moscow (Russian Federation)); Safonova, V.A.; Isachenko, V.M.; Gusarova, M.L.; Kudryavtseva, M.P. RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. 87p. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BIOLOGICAL MODELS/biological radiation effects; IMMUNITY/ionizing radiations; IMMUNITY; LABORATORY ANIMALS

22455 (INIS-RU–406, pp. 13) **Processes of radiation biological technology for prevention of bioinjuries and corrosion of biogenic nature in oil production.** Kaushanskij, D.A. (RAN, Moscow (Russian Federation). Inst. Problem Nefti i Gaza). RAN, Moscow (Russian Federation). Nauchnyj Sovet po Problemam Radiobiologii. 1994. (In Russian). (CONF-9404263–: All-Russia conference of applied aspects of radiobiology, Moscow (Russian Federation), 19-20 Apr 1994). In *All-Russian conference on applied aspects of radiobiology. Exhibition Radiobiology for practice.* 87p. Order Number DE95632291. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BACTERIA/radiosterilization; CORROSION PROTECTION/radiosterilization; BACTERIA; RADIOSTERILIZATION; BIOGEOCHEMISTRY; ECOSYSTEMS; INJURIES; IONIZING RADIATIONS; OIL WELLS; PETROCHEMICAL PLANTS; PETROLEUM DEPOSITS; PETROLEUM INDUSTRY; SULFATES

22456 (K/TCD–1127) **Evaluation of gas-phase technetium decontamination and safety related experiments during FY 1994. A report of work in progress.** Simmons, D.W.; Munday, E.B. Oak Ridge K-25 Site, TN (United States). May 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012978. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory activities for FY94 included: evaluation of decontamination of Tc by gas-phase techniques, evaluation of diluted ClF_3 for removing U deposits, evaluation of potential hazard of wet air inlekage into a vessel containing ClF_3, planning and preparation for experiments to assess hazard of rapid reaction of ClF_3 and hydrated UO_2F_2 or powdered Al, and preliminary evaluation of compatibility of Tenic valve seat material.

22457 (LA–12952-MS) **Determination of plutonium activity levels and $^{240}Pu/^{239}Pu$ isotope ratios in bone collected from nonoccupationally-exposed individuals living in Colorado.** Efurd, D.W.; Benjamin, T.M.; Aguilar, R.D.; Roensch, F.R.; Perrin, R.E.; Gonzales, E.R.; McInroy, J.F. Los Alamos National Lab., NM (United States). Apr 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95010555. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos scientists measured $^{239+240}Pu$ alpha activities and $^{240}Pu/^{239}Pu$ atom ratios in bone tissues collected from Colorado residents who were not occupationally exposed to this type of radioactivity. Bone tissues from 519 individuals were collected from 1975 to 1979 as part of an Environmental Protection Agency directed project to determine the effect of plutonium on people who live in areas surrounding the Rocky Flats Plant. Los Alamos selected 59 individuals who were suspected of having high plutonium body burdens based on the plutonium content of their livers. The plutonium activity level in the subset of bones analyzed in this study contained 7.8 $\pm$ 9.4 pCi $^{239+240}Pu$/10 kg wet weight. The average $^{240}Pu/^{239}Pu$ atom ratio was 0.182 $\pm$ 0.068; this ratio suggests that the plutonium detected in these individuals originated predominantly from global fallout.

22458 (LA-UR–95-1305) **GIS as a tool for managing radiological areas in Los Alamos.** Johnson, S.L.; Lloyd, S.C.; Wenzel, W.J. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract W-7405-ENG-36. (CONF-9504158–3: CAD/CAE conference, Atlanta, GA (United States), 19 Apr 1995). Order Number DE95014016. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents details about the GIS information system development to support reporting requirements of occupational safety regulations. This system is being designed to give information about the level of radiation in an area and to make this information readily available to all workers before entering any area.

22459 (NIRS-M–98, pp. 73-85) **The emergency medical programs of japan and foreign countries for radiation accidents in nuclear power stations.** Aoki, Yoshiro (Tokyo Univ. (Japan). Faculty of Medicine). National Inst. of Radiological Sciences, Chiba (Japan). Mar 1994. (In Japanese). (CONF-9312105–: 21. National Institute of Radiological Sciences, Chiba (Japan), 2-3 Dec 1993). In *Dose assessment and approach to the safety for the public in the emergency. Proceedings.* 210p. Order Number DE95747912. Source: OSTI; NTIS; INIS.

In our country, the medical emergency programs for the people living near nuclear power stations are well organized, however, preparation of medical staffs who are well trained is considered to be not sufficient. In the USA, on call 24 hours response to a radiological emergency is provided and funded by Department of Energy(DOE) or electric companies. Especially, REAC/TS is a part of DOE response network, in which there are provided well-trained physicians, nurses, health physicists, coordinators and support personnels. In United Kingdom, National Radiological Protection Board(NRPB) is responsible to a radiological emergency program. Each nuclear power station has its own emergency program consisting of a team of physicians, nurses and health physicists. In France, French Atomic Energy Commission (CEA) is a responsible agency for a radiological emergency program. On call 24 hours response to a radiological emergency is provided in Fontenay-aux Roses Institute and Curie Institute. Curie Institute also responds to radiological emergencies in other countries at the request of WHO. In Germany(West Germany), compulsory assurance system covers a radiological emergency program and a radiological protection. There are seven centers in West Germany, in which well-trained medical staffs are provided against radiological injuries. In this report, I tried to propose a new concept about emergency medical programs for nuclear power station accidents in Japan. I think it is a very urgent theme to provide on call 24 hours radiological emergency program, in which patients suffered from acute radiation sickness with internal contamination or contaminated radiation burns will be treated without any trouble. We have to make our best efforts to complete basic or clinical research about radiation injuries including bone marrow transplantation, radioprotectors, chelating agents and radiation burns etc. (J.P.N.).

22460 (NIRS-M–98, pp. 86-105) **Whole-body counting and its application to the internal exposure measurement.** Mizushita, Seiichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). National Inst. of Radiological Sciences, Chiba (Japan). Mar 1994. (In Japanese). (CONF-9312105–: 21. National Institute of Radiological Sciences, Chiba (Japan), 2-3 Dec 1993). In *Dose assessment and approach to the safety for the public in the emergency. Proceedings.* 210p. Order Number DE95747912. Source: OSTI; NTIS; INIS.

Whole-body counter is used to determine radioactivities in the body by detecting their gamma rays and the result is applied to estimate the internal dose. In accidental situations, whole-body counter is most effectively applied to evaluate the radiation effects of the body incurred by incorporation of radioactivities. It is generally used in the internal exposure monitoring program of radiation workers in nuclear installations. The detection limit is several tens Bq for the precise counter and several hundreds Bq for the small counter. The body burden and its retention with the time are observed by the measurement and the time integral of the activity for the dose evaluation is calculated. The more practical way of dose evaluation is made based on the estimation of intake from the observed body burden. Calibration of the counters is usually carried out using whole body anthropomorphic phantom. The intercomparison study using anthropometric phantoms of different size, adult, 11 years old and 3 years old, were carried out between JAERI, NIRS and PNC. Through this study, validation of the calibration data and body size effect on counting efficiency were investigated. The calibration network will be need to establish the hierarchy of the standardization of calibration of whole-body counter. The standardization is also required in accidental situations which ensure the results of the subsequent studies. The cooperative study for the calibration of whole-body counter for the purpose of investigation on health effect of low radiation dose are continuing between Ukraine and Japan from 1989. The results shows the validation of the calibration of the counter for the measurement of the public affected by Chernobyl accident. (author).

22461 (NIRS-M–98, pp. 106-120) **Exposure dose assessment using bioassay.** Suga, Shinichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). National Inst. of Radiological Sciences, Chiba (Japan). Mar 1994. (In Japanese). (CONF-9312105–: 21. National Institute of Radiological Sciences, Chiba (Japan), 2-3 Dec 1993). In *Dose assessment and approach to the safety for the public in the emergency. Proceedings.* 210p. Order Number DE95747912. Source: OSTI; NTIS; INIS.

Bioassay involves following steps: sampling, pre-treatment, chemical separation and counting of radioactivity. As bioassay samples, urines are usually used, although faecal analysis may be required in some occasions for example to assess intake of non-transferable radioactive materials. Nasal smear is a useful indicator of an inhalation case. Exhalation air is used to estimate the intake of tritiated water. Sample pre-treatment includes evaporation for concentration, wet ashing, dry ashing and co-precipitation. After adding small amount of nitric acid, the sample can be concentrated by 1/10 of initial volume, which may be used to identify γ-emitters. As the pre-treatment of urine, wet ashing is used for example for analysis of Pu, and co-precipitation is used for example for analysis of Sr. Dry ashing by electric furnace is usually adopted for faecal samples. Methods of chemical separation depend on the radionuclide(s) to be analysed. The detection limit depends also on radionuclide, and for example typical detection limits are 0.4Bq /l (volume of urine sample) for ^{89}Sr or ^{90}Sr, and 0.01 Bq /l with urine and 0.01 Bq per sample with faeces for ^{238}Pu, ^{239}Pu or ^{241}Am. Simpler methods can be used for some radionuclides: For example, radioactivity concentration of tritium can be determined by liquid scintillation counting of urine or condensed water from exhaled air, and natural uranium in urine can be quantified by using fluorometric method. In some circumstances, gross-α or gross-β analyses are useful for quick estimation. To estimate intakes by inhalation or by ingestion from bioassay results and to assess the committed dose equivalent, commonly available bases are the relevant publications by the ICRP and domestic guides and manuals that conform to the radiation protection regulations. (author).

22462 (NUREG–1492) **Regulatory analysis on criteria for the release of patients administered radioactive material.** Schneider, S. (Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications); McGuire, S.A.; Behling, U.H.; Behling, K.; Goldin, D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Cohen (S.) and Associates, Inc., McLean, VA (United States). May 1994. 31p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The Nuclear Regulatory Commission (NRC) has received two petitions to amend its regulations in 10 CFR Parts 20 and 35 as they apply to doses received by members of the public exposed to patients released from a hospital after they have been administered radioactive material. While the two petitions are not identical they both request that the NRC establish a dose limit of 5 millisieverts (0.5 rem) per year for individuals exposed to patients who have been administered radioactive materials. This Regulatory Analysis evaluates three alternatives. Alternative 1 is for the NRC to amend its patient release criteria in 10 CFR 35.75 to use the more stringent dose limit of 1 millisievert per year in 10 CFR 20.1301(a) for its patient release criteria. Alternative 2 is for the NRC to continue using the existing patient release criteria in 10 CFR 35.75 of 1,110 megabecquerels of activity or a dose rate at one meter from the patient of 0.05 millisievert per hour. Alternative 3 is for the NRC to amend the patient release criteria in 10 CFR 35.75 to specify a

dose limit of 5 millisieverts for patient release. The evaluation indicates that Alternative 1 would cause a prohibitively large increase in the national health care cost from retaining patients in a hospital longer and would cause significant personal and psychological costs to patients and their families. The choice of Alternatives 2 or 3 would affect only thyroid cancer patients treated with iodine-131. For those patients, Alternative 3 would result in less hospitalization than Alternative 2. Alternative 3 has a potential decrease in national health care cost of $30,000,000 per year but would increase the potential collective dose from released therapy patients by about 2,700 person-rem per year, mainly to family members.

22463 (NUREG/CR–6112) **Impact of reduced dose limits on NRC licensed activities. Major issues in the implementation of ICRP/NCRP dose limit recommendations: Final report.** Meinhold, C.B. (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (United States). May 1995. 65p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52394). Source: OSTI; NTIS; GPO; INIS.

This report summarizes information required to estimate, at least qualitatively, the potential impacts of reducing occupational dose limits below those given in 10 CFR 20 (Revised). For this study, a questionnaire was developed and widely distributed to the radiation protection community. The resulting data together with data from existing surveys and sources were used to estimate the impact of three dose-limit options; 10 mSv yr^{-1} (1 rem yr^{-1}), 20 mSv yr^{-1} (2 rem yr^{-1}), and a combination of an annual limit of 50 mSv yr^{-1} (5 rem yr^{-1}) coupled with a cumulative limit, in rem, equal to age in years. Due to the somewhat small number of responses and the lack of data in some specific areas, a working committee of radiation protection experts from a variety of licensees was employed to ensure the exposure data were representative. The following overall conclusions were reached: (1) although 10 mSv yr^{-1} is a reasonable limit for many licensees, such a limit could be extraordinarily difficult to achieve and potentially destructive to the continued operation of some licensees, such as nuclear power, fuel fabrication, and medicine; (2) twenty mSv yr^{-1} as a limit is possible for some of these groups, but for others it would prove difficult. (3) fifty mSv yr^{-1} and age in 10s of mSv appear reasonable for all licensees, both in terms of the lifetime risk of cancer and severe genetic effects to the most highly exposed workers, and the practicality of operation.

22464 (PNL–10500-Pt.1) **Pacific Northwest Laboratory annual report for 1994 to the DOE Office of Energy Research Part 1: Biomedical sciences.** Park, J.F. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012231. Source: OSTI; NTIS; GPO Dep.

Research in the biomedical sciences at PNL is described. Activities reported include: inhaled plutonium in dogs; national radiobiology archives; statistical analysis of data from animal studies; genotoxicity of inhaled energy effluents; molecular events during tumor initiation; biochemistry of free radical induced DNA damage; radon hazards in homes; mechanisms of radon injury; genetics of radon induced lung cancer; and in vivo/in vitro radon induced cellular damage.

22465 (PNL–10523) **Multimedia Environmental Pollutant Assessment System (MEPAS®): Exposure pathway and human health impact assessment models.** Strenge, D.L.; Chamberlain, P.J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012763. Source: OSTI; NTIS; GPO Dep.

The Multimedia Environmental Pollutant Assessment System (MEPAS) provides physics-based models for human health risk assessment for radioactive and hazardous pollutants. MEPAS analyzes pollutant behavior in various media (air, soil, groundwater and surface water) and estimates transport through and between media and exposure and impacts to the environment, to the maximum individual, and to populations. MEPAS includes 25 exposure pathway models, a database with information on more than 650 contaminants, and a sensitivity module that allows for uncertainty analysis. Four major transport pathways are considered in MEPAS: groundwater, overland, surface water, and atmospheric. This report describes the exposure pathway and health impact assessment component of MEPAS, which provides an estimate of health impacts to selected individuals and populations from exposure to pollutants. The exposure pathway analysis starts with pollutant concentration in a transport medium and estimates the average daily dose to exposed individuals from contact with the transport medium or a secondary medium contaminated by the transport medium. The average daily dose is then used to estimate a measure of health impact appropriate to the type of pollutant considered. Discussions of the exposure pathway models include the assumptions and equations used to convert the transport medium concentrations to exposure medium concentrations. The discussion for a given exposure pathway defines the transport pathways leading to the exposure, the special processes considered in determining the pollutant concentration in the exposure medium, and the exposure model used to estimate the average daily dose. Models for the exposure pathway and health impact assessments require definition of several parameters. A summary of the notation used for these parameters is provided.

22466 (STUK/ST-GUIDE–12.3) **Radioactivity of household water.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1994. 10p. Order Number DE95631118. Source: OSTI; NTIS; INIS.

Translation. The original text in Finnish is published under the same guide number. The guide is valid from 1 September 1993 and will remain in force until further notice.

The guide presents the safety requirements to limit the radiation exposure due to the radioactive nuclides in household water. The requirements does not apply during extraordinary circumstances, as during fallout due to an accident at a nuclear power station. (2 refs., 1 tab.).

22467 (UCRL-CR–120647) **Attachment of radon progeny to cigarette-smoke aerosols.** Biermann, A.H.; Sawyer, S.R. Lawrence Livermore National Lab., CA (United States). May 1995. 42p. Sponsored by California Univ., Berkeley, CA (United States). DOE Contract W-7405-ENG-48. Order Number DE95013271. Source: OSTI; NTIS; INIS; GPO Dep.

The daughter products of radon gas are now recognized as a significant contributor to radiation exposure to the general public. It is also suspected that a synergistic effect exists with the combination cigarette smoking and radon exposure. We have conducted an experimental investigation to determine the physical nature of radon progeny interactions with cigarette smoke aerosols. The size distributions of the aerosols are characterized and attachment rates of radon progeny to cigarette-smoke aerosols are determined. Both the mainstream and sidestream portions of the smoke aerosol are investigated. Unattached radon progeny are very mobile and, in the presence of aerosols, readily attach to the particle surfaces. In this study, an aerosol chamber is used to contain the radon gas, progeny and aerosol mixture while allowing the attachment process to occur. The rate of attachment is dependent on the size distribution, or diffusion coefficient, of the radon progeny as well as the aerosol size distribution. The size distribution of the radon daughter products is monitored using a graded-screen diffusion battery. The diffusion battery also enables separation of the unattached radon progeny from those attached to the aerosol particles. Analysis of the radon decay products is accomplished using alpha spectrometry. The aerosols of interest are size fractionated with the aid of a differential mobility analyzer and cascade impactor. The measured attachment rates of progeny to the cigarette smoke are compared to those found in similar experiments using an ambient aerosol. The lowest attachment coefficients observed, $\sim 10^{-6}$ cm^3/s, occurred for the ambient aerosol. The sidestream and mainstream smoke aerosols exhibited higher attachment rates in that order. The results compared favorably with theories describing the coagulation process of aerosols.

22468 (UCRL-JC–119377) **Coupled light transport-heat diffusion model for laser dosimetry with dynamic optical properties.** London, R.A. (Lawrence Livermore National Lab., CA (United States)); Glinsky, M.E.; Zimmerman, G.B.; Eder, D.C.;

Jacques, S.L. Lawrence Livermore National Lab., CA (United States). 1 Mar 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–41: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95011747. Source: OSTI; NTIS; INIS; GPO Dep.

The effect of dynamic optical properties on the spatial distribution of light in laser therapy is studied via numerical simulations. A two-dimensional, time dependent computer program called LATIS is used. Laser light transport is simulated with a Monte Carlo technique including anisotropic scattering and absorption. Thermal heat transport is calculated with a finite difference algorithm. Material properties are specified on a 2-D mesh and can be arbitrary functions of space and time. Arrhenius rate equations are solved for tissue damage caused by elevated temperatures. Optical properties are functions of tissue damage, as determined by previous measurements. Results are presented for the time variation of the light distribution and damage within the tissue as the optical properties of the tissue are altered.

22469 (UCRL-JC–120178) **Modeling of endovascular patch welding using the computer program LATIS.** Glinsky, M.E. (Lawrence Livermore National Lab., CA (United States)); London, R.A.; Zimmerman, G.B.; Jacques, S.L. Lawrence Livermore National Lab., CA (United States). 1 Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–42: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95011749. Source: OSTI; NTIS; INIS; GPO Dep.

A new computer program, LATIS, being developed at Lawrence Livermore National Laboratory is used to study the effect of pulsed laser irradiation on endovascular patch welding. Various physical and biophysical effects are included in these simulations: laser light scattering and absorption, tissue heating and heat conduction, vascular cooling, and tissue thermal damage. The geometry of a patch being held against the inner vessel wall (500 μm inner diameter) by a balloon is considered. The system is exposed to light pulsed from an optical fiber inside the balloon. A minimum in the depth of damage into the vessel wall is found. The minimum damage zone is about the thickness of the patch material that is heated by the laser. The more ordered the tissue the thinner the minimum zone of damage. The pulse length which minimizes the zone of damage is found to be the time for energy to diffuse across the layer. The delay time between the pulses is determined by the time for the heated layer to cool down. An optimal pulse length exists which minimizes the total time needed to weld the patch to the wall while keeping the thickness of the damaged tissue to less than 100 μm. For the case that is considered, a patch dyed with light absorbing ICG on the side next to the vessel (thickness of the dyed layer is 60 μm), the best protocol is found to be 65-200 ms pulses applied over 2 min.

22470 (VAEC-C–024) **Overexposure measurement on microtron MT-17.** Dang Thanh Luong (Institute of Nuclear Science and Technology, Hanoi (Viet Nam)); Tran Thanh Minh. Viet Nam National Atomic Energy Commission, Ha Noi (Viet Nam). 1995. 10p. Order Number DE95632331. Source: OSTI; NTIS (US Sales Only); INIS.

On 11 November 1992, the Radiation accident happened at the channel of the high energy photon beam generated by stopping 15 MeV accelerated electron on the tungsten target of Microtron MT-17. One physicist has been exposed to the high energy photon beam. The purposes of this work are the determination of overexposure from backscatter and primary beams to estimate the whole body and hand doses received by the victim. It was found that the upper parts of his body may be received the dose from 1.0 Gy to 5.0 Gy per 4 min. of the exposure; the dose received by victim's hands is in interval of 30 - 50 Gy. (author). 3 refs., 5 figs., 5 tabs.

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22471 (DOE/NV/11432–177) **1994 Baseline biological studies for the Device Assembly Facility at the Nevada Test Site.** Townsend, Y.E. (ed.); Woodward, B.D.; Hunter, R.B.; Greger, P.D.; Saethre, M.B. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Feb 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-94NV11432. Order Number DE95011828. Source: OSTI; NTIS; GPO Dep.

This report describes environmental work performed at the Device Assembly Facility (DAF) in 1994 by the Basic Environmental Monitoring and Compliance Program (BECAMP). The DAF is located near the Mojave-Great Basin desert transition zone 27 km north of Mercury. The area immediately around the DAF building complex is a gentle slope cut by 1 to 3 m deep arroyos, and occupied by transitional vegetation. In 1994, construction activities were largely limited to work inside the perimeter fence. The DAF was still in a preoperational mode in 1994, and no nuclear materials were present. The DAF facilities were being occupied so there was water in the sewage settling pond, and the roads and lights were in use. Sampling activities in 1994 represent the first year in the proposed monitoring scheme. The proposed biological monitoring plan gives detailed experimental protocols. Plant, lizard, tortoise, small mammal, and bird surveys were performed in 1994. The authors briefly outline procedures employed in 1994. Studies performed on each taxon are reviewed separately then summarized in a concluding section.

22472 (ETDE-DE–115) **Final report on the research project 'Air pollution and forest damage in North-Rhine Westphalia'. Aims, results, conclusions. A balance of nine years of forest damage research in North-Rhine Westphalia.** Koeth-Jahr, I. (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany)). Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany). Jun 1993. 173p. (In German). Order Number DE95785950. Source: OSTI; NTIS (US Sales Only).

The present report takes stock of nine years of forest damage research in North Rhine - Westphalia. After first relating current hypotheses on the causes of the novel type of forest damage (soil acidification, photooxidants, nitrogen, stress) it deals with the results of field and laboratory studies; the monitoring and recording of forest damage; pollution situation in wooded areas (ozone, sulphur dioxide, nitrogen oxides, air-borne dust, hydrocarbons) and pollutant deposition in spruce and beech; and the soil and climate situation (wind, air humidity, fog, precipitation, temperature, sunshine hours) in different parts of the Land. It then goes on to discuss atmosphere-chemical processes and long-distance transport phenomena (esp. of peroxides and natural terpenes); deposition measurements and soil analyses (protons, ammonia); heavy metal concentrations and toxicity; and, in particular detail, the effects of air pollutants on spruce and beech (foliar loss, mycorrhiza, growth parameters, elemental concentrations in foliage and soil and their change during the period under study). The measurements from the sites of Eggegebirge, Rothaargebirge, and Haardt are compared. The book closes with an inquiry into possibilities of emission abatement and effects of such measures. (orig.)

22473 (ETDE-DE–117) **Studies at the Wank environmental monitoring base on the xanthophyll cycle as a biomonitor for stress influences of air pollutants and climate in field conditions.** Luetz, C.; Dodell, B.; Kuhnke, R.; Preiser, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Nov 1994. 91p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). Order Number DE95785648. Source: OSTI; NTIS (US Sales Only).

Pigments of spruce needles of selected, varyingly damaged trees were studied over a two-year period in two intensive measuring areas of site elevation 910 m and 1575 m, respectively, on Wank. This was the first ever project to study and describe the light and temperature kenetics of the xanthophyll cycle pigments all

year round. It was found that chlorophylls and the family of carotinoids differ in their circannual dynamic behaviour, and that accumulation of these pigments decreases with growing height; individual carotinoids sometimes change their behaviour, e.g., alpha and beta carotin, whose maxima in winter and summer afford the photosynthesis reaction centres protection all year round. Furthermore, kinetic analyses clearly showed that oxidative and photoinhibitory stresses are greater on plateau than on lower sites. Contrary to statements found in the literature, the viola/antheraxanthin ratio is not suited as an early indicator of forest damage. The xanthophyll cycle has proven unsuitable for screening tasks in damage diagnostics in the field. Simulation experiments on young spruce in exposition chambers provided a valuable basis for validating field data. For example, the assumption that ozone counts among the major air pollutants was thus corroborated also for the Wank region. (orig.)

22474 (ETDE-DE–118) **Comparative studies on mycorrhiza and microfungi in the rhizosphere after acid sprinkle irrigation and liming at a spruce stand in 'Hoeglwald'. Final report.** Qian, X.M.; El-Ashkar, A.; Kottke, I.; Oberwinkler, F. Tuebingen Univ. (Germany). Botanisches Inst. [1995]. 89p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0339175E. Order Number DE95785630. Source: OSTI; NTIS (US Sales Only).

A comparative study was made of the fungal microflora populations of the mycorrhizoplane of a 75 to 80-year-old spruce stand and a 140-year-old beech stand in Hoeglwald. The soil of the experimental spruce stand had been subjected to acid sprinkle irrigation or liming from 1984 to 1990. An untreated spruce stand and a neighbouring beech stand served as controls. Eight isolated microfungal species exhibiting pathogenic or antagonistic action were compared with respect to their distribution in the five experimental areas. The species studied were trichoderma viride Pers. ex S.F. Gray. T hamatum (Bon.) Bain, T polysporum (Link ex Pers.) Rifai, cylindrocarpon destructans (Zinsm.) Scholten, sesquicillium candelabrum (Bonorden) Gams, mycelium radicis atrovirens Melin, tolypocladium geodes Grams, oidiodendron majus Barron. Both liming and acid sprinkle irigation disturbed the biological equilibrium of the soil microflora. This mainifested itself in a shift in interspecific dominance. For example, the area subjected to acid sprinkle irrigation showed proliferation of mycelium radicis atrovirens and oidiodendron majus, sterile mycelia and yeast plants, and a decline in the distribution of trichoderma species, whereas sesquicillium candelabrum and cylindrocarpon were found to porliferate in the lined area. A side from the altered soil conditions due to the treatment, the change in dominance relationships is attributed above all to direct interactions between fungal species. (orig.)

22475 (ETDE-DE–119) **Capacity for oxidative and reductive detoxification of NO_x and SO_2 and for neutralisation of acid in leaves and needles of forest trees. Final report.** Heber, U. (Wuerzburg Univ. (Germany). Julius-von-Sachs-Institut fuer Biowissenschaften mit Botanischem Garten); Slovik, S. Wuerzburg Univ. (Germany). Julius-von-Sachs-Institut fuer Biowissenschaften mit Botanischem Garten; Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1994. 214p. (In German). Order Number DE95785628. Source: OSTI; NTIS (US Sales Only).

This final report presents analysis data of all the mineral substances found in samples of timber, bark, foliage, and leaf litter from healthy individuals of 17 tree species. These data permit calculating organic anion concentrations as well as the amount of protons produced endogenously during organ growth and subsequently neutralised metabolically in healthy trees. This later quantity is important for estimating the relative proton load resulting from stomatal uptake of trace gases, in particular potentially acid air pollutants. The paper reports on very detailed studies on substances found, endogenous proton production during organ growth, and differential organ growth rates in picea abies at different sites. Chemical analyses in needles needle litter, wood and bark of root and stem, respectively, and the individual growth rates of these organs permit calculating, firstly, the entire yearly nutrient requirements in organic sulphur and nitrogen compounds broken down by silvicultural yield class (WIEDEMANN Tables), thinning scenarios, stand age, and mean needle age; and secondly, the most important ecosystemic nutrient circulation rates for all major plants nutrients. Furthermore, the system of wood-physiological pH-stat-mechanisms in the spruce corm and the yearly proton extrusion rate into the soil for NO_3^- and NH_4^+ phytotrophy in spruce were quantified. Finally, yearly stomatal trace gas, specifically SO_2, No_x, and O_3, uptake in native spruce crowns were quantified as a function of mean annual air pollutant levels and length of vegetation period. (orig.)

22476 (ETDE-DE–121) **Comparative protein microanalysis in the partners of a mycorrhizal symbiosis after acid sprinkle irrigation and liming at a spruce stand in 'Hoeglwald'. Final report.** Guttenberger, M.; Zick, H.; Hampp, R. Tuebingen Univ. (Germany). Botanisches Inst. [1994]. 58p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0339175K. Order Number DE95785667. Source: OSTI; NTIS (US Sales Only).

A study was performed on a dominant species (piceirhiza nigra) inhabiting the areas subjected to liming in the Hoeglwald project. The results were as follows. Activity of the glucose-6-phosphate-dehydrogenase enzyme was lower in mycorrhiza in areas subjected to liming and acid sprinkle irrigation than in areas subjected to liming only. As the newly developed method of quantitative enzyme electrophoresis (electrophoretic separation of the enzymes of the two symbiotic partners, densitometric evaluation) showed, this effect was largely due to a lower activity on the part of the fungus. Since other enzymes were not affected, this seems to have been a regulative process. The fungal partner accounted for the greater part of glucose-6-phosphate-dehydrogenase activity of the mycorrhiza regardless of the kind of treatment. During the two vegetation periods covered, fluctuations in specific enzyme activity were low in both areas. The results show that the treatment had induced changes in soil conditions which had a physiologically relevant impact on mycorrhizal metabolism (primarily that of the fungus). A direct impact, e.g., through the direct action of water or acid can be excluded as the examinations weren't started until after the termination of sprinkle irrigation. (orig.)

22477 (ETDE-DE–122) **Examination of activity along secondary metabolic pathways in spruce and pine as possible indicators of damage symptoms in the elevation profile of Wank. Final report.** Heller, W.; Rosemann, D.; Sandermann, H. Jr.; Henn, A.; Steinke, S.; Klotz, R. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Inst. fuer Biochemische Pflanzenpathologie. 30 Sep 1994. 114p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). Project Number PBWU 6495-1053-77291. Order Number DE95785649. Source: OSTI; NTIS (US Sales Only).

Methanol-solable as well as cell-wall-bound secondary metabolites in spruce, pine, and dwarf pine growing on Wank were found to differ in dependence of site elevation. All-year monitoring of various metabolites showed that trees of elevation zone IV differ markedly from trees of zones I and VII. As yet it has not been possible to establish a relationship between these compounds as possible biomarkes and the damage stage of the trees sampled. In the case of dwarf pine, the metabolites analysed vary in concentration in dependence of UV-B radiant intensity. These acylated flavonol derivates occur exclusively in the epidermis where they serve as an effective shield against the incident UV radiation. Measurements were performed in controlled experiments on spruce, pine, and dwarf pine kept in exposure chambers. The plants were exposed to a climate typical of Wank save for the experimental variables of ozone concentration, which was kept either at ambient or double the ambient level, and UV-B radiation, which was administered in very high and very low doses. It was found that the 4-coumaric acid-acylated flavonol glycosides are induced by UV-B radiation and that ozone inhibits this induction. Model studies on interactions between heterobasidion annosum and ozone in pine seedlings once with and once without a mycorrhiza partner showed that mycorrhiza are largely capable of protecting the plant and that a pathogen attack on its roots render the plant very sensitive to ozone. (orig.)

22478 (ETDE-DE–129) **Influence of gaseous pollutants on the biosynthesis of plant cuticles and their impact on transport properties. Final report.** Lendzian, K.J. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Jun 1992. 25p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). Order Number DE95780182. Source: OSTI; NTIS (US Sales Only).

The second part of the research project yielded the following results: 1. Exposing oak, beech, ivy and fir plants to a base load and temporarily increased load of the vapour phase pollutants ozone, SO_2 and NO_2 does not result in a change of the mass saturation of the leaf cuticles. Cuticles do not become thicker or thinner; the amount of cutin and wax is not changed by fumigation. 2. The biosynthesis of the cuticle components wax and cutin is not affected by long-term fumigation with gaseous pollutants. The turnover of substrates within the biosynthesis chain is not altered. 3. Also in the case of simultaneous fumigation and measurement of biosynthesis performance in leaves no differences between the controls and treated plants are noted. 4. The biosynthesis performance of leaves with a view to the building up cuticles is not impaired by the gaseous pollutants ozone, SO_2 and NO_2. Nor do these gaseous pollutants, even in combination, alter the transport properties of cuticles. 5. SO_2 sorption by cuticles of Abies alba was more closely characterized. In the case of environmentally relevant concentrations, dry deposition may well result in a partition coefficient of around 10^6. But it takes more than seven days till sorption reaches steady-state. (orig./UWA)

22479 (ETDE-DE–130) **Ozone effects on plants. Evaluation of ozone profiles measured in Hessen.** Umweltplanung, Arbeits- und Umweltschutz. Schriftenreihe der Hessischen Landesanstalt fuer Umwelt, v. 143. Gruenhage, L.; Herm, K.; Hanewald, K.; Jaeger, H.J. Hessische Landesanstalt fuer Umwelt, Wiesbaden (Germany); Giessen Univ. (Germany). Inst. fuer Pflanzenoekologie. 1992. 80p. (In German). Order Number DE95780160. Source: OSTI; NTIS (US Sales Only).

The study had the aim to evaluate ozone measuring data from selected air pollution measuring stations in Hessen with a view to possible hazards to the vegetation. A model which describes not only O_3 concentrations in the ambient air but takes also the exchange properties of the atmosphere and sink properties of plants into account and whose key parameter is related to O_3-induced disease symptoms in plants in an unequivocal manner could be evolved for Nicotiana tabacum. The following data for making use of this model can be provided by federal and laender air hygiene measuring stations: O_3 concentration in the ambient air, air temperature, air humidity, horizontal wind speed, global radiation. Assessing the O_3 exposure of the vegetation using the new parameters RISK(1) and RISK(2) leads to a more precise result in ecological terms than employing the quantities commonly used. - The calculation of risk parameters for different farm crops relies on exposure-and-effect functions mentioned in literature. According to these, only barley and maize are to be considered as O_3-tolerant. For all other crops great differences in tolerance from one species to another and between the different years are reported. The substantial potential drop in summer wheat yield is particularly striking. Previous investigations have not taken into account a possible compensation of lower yield through ozone by the increase of the CO_2 concentration from approximately 290 ppm to, currently, about 360 ppm: where the CO_2 fertilization effect and potential O_3-induced yield loss are simultaneously considered the two cancel each other out due, probably, to an additive combination effect. Accordingly, prognostications for higher yields because of the increase of the CO_2 concentration are incorrect where O_3 sensitive crops are concerned. (orig./UWA)

22480 (GSF–39/93, pp. 255-264) **Results of sulphur and nitrogen measurements in samples of the Austrian bio-indicator network.** Stefan, K. (Forstliche Bundesversuchsanstalt, Wien (Austria)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Results of chemical needle analyses of the Austrian bioindicator network show that on a nationwide scale the importance of SO2 in forest-damaging air pollution has not decreased; within 10 years of monitoring there have, however, been some shifts of areas that show the effects of sulphur immissions just as there have also been some local or regional improvements. With increasing sea level there were fewer instances where maximum values were exceeded but increasing areas which received the overall classification 1 that is to say results of chemical needle analyses did not point to immission effects of S. A considerable part of the areas with S-immission effects are assumed to be victims of transborder immissions. A negative influence of N-carry-over on the nutrient element balance can only be assumed for certain local sites. Where N-supply is concerned (which over all the years where main nutrient were studied showed the largest deficiency) there is a strong regional differentiation and therefore - as the results of the S/N ratio indicates - also different effects of sulphur immissions. (orig./EW).

22481 (GSF–39/93, pp. 284-293) **Atmospheric carry-over of N and absorption of N in spruce stands of Northern Bavaria.** Bruckner, G. (Lehrstuhl fuer Pflanzenoekologie, Univ. Bayreuth (Germany)); Schulze, E.D.; Gebauer, G. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Tests with ^{15}N marked nitrogen compounds showed that surface absorption in spruces plays an decisive role in the induction of nutrient imbalances in spruce ecosystems. Absorption of NH_4^+ and NO_3^- by surface plant organs is assumed to account for one third of the demand and is therefore an important parameter in the N-household of forest trees. Absorption of NO_x and NH_3 depends on wind velocities, air humidity and the additional occurrence of other noxious gases. Age, nitrogen nutrition of plants and stomatary conductivity also influence absorption. Concentration being the same NH_3 is absorbed at a far higher rate than NO_x and therefore has the same importance for the nitrogen balance of forest trees as NO_x even though NH_3 concentrations in the Fichtelgebirge are far lower than NO_x concentrations. In order to reduce nitrogen-induced forest damage and reduce nitrogen emissions it is necessary to impose restrictions not only on road traffic and industry but also on agriculture. (orig./EW).

22482 (GSF–39/93, pp. 311-319) **Changes in growth of spruce stands in Southern Bavaria.** Roehle, H. (Lehrstuhl fuer Waldwachstumskunde, Univ. Muenchen (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The essential results of the growth studies carried out in Southern Bavarian spruce stands are: 1. Damaged spruce stands show regionally differentiated relations between growth and vitality; this allows derive assessment function for the determination of pollutant-induced lack of growth. 2. In non-damaged spruce stands growth over the last 100 years can be subdivided into two phases of contradictory behaviour: a first phase conform to models where growth rates, after exceeding culmination slowed dowed with age, this phase lasted from the end of the 19th centruy until the 1950s of this century. A subsequent phase where growth rates remain steady or even increase with increasing age, this is contradictory to scientific opinion. In this phase there is a growth development which is clearly different from model curves both in terms of direction and in terms of levels. (orig./EW).

22483 (GSF–39/93, pp. 344-351) **Nitrogen carry-over in mountaineous peatland.** Pohl, W. (Limnologische Station des Inst. fuer Botanik und Mikrobiologie, TU Muenchen (Germany)); Melzer, A. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

A comprehensive study, conducted in 1990 and 1991 looked into the effects of nitrogen carry-over on the nitrogen metabolism in sphagnum growing on peat in the field. The area concerned is called Loisachfilze and located 9 km north of Kochel. Different concentrations of ammonia and nitrate were applied to selected test areas. In order to quantify the reaction of sphagnacea on this fertilisation enzyme activity of nitratreductase (NR) which catalyses the first step in nitrate assimilation, was measured. At the same time the nitrogen content of peat moss and peat water was measured. The N-metabolism of peat moss was also measured all over Bavaria. Enzyme activity turned out to be difficult as a biotest for establishing the present state of peat areas in higher altitudes. Several months of nitrogen fertilisation caused NR inhibition in sphagnum cuspidyatum and S. magellanicum. Nitrate reductase inhibition at high NO_3 concentrations (25kg/ha/year) was stronger in 1990 than in 1991 where nitrate addition was (only 16.6kg/ha/annum) Ammonia too caused an inhibition of nitrate reductase activity. Analysis of moor water from the Loisachfilze showed clearly increased nitrate concentrations on the area fertilised with this nutrient. Once phagnacea can no longer sufficiently retain the nitrate from increasing air pollution it can penetrate into the root section of higher plants. In this case nitrophilic plants would very likely start to propagate. They may replace sphagnum and change the typical vegetation of high-altitude peat areas. (orig./EW)

22484 (GSF–39/93, pp. 448) **The synergism between SO_2 oxidation and manganese leaching on spruce needles - a chamber experiment.** Burkhardt, J. (BITOEK, Abt. Klimatologie, Univ. Bayreuth (Germany)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication SULFUR DIOXIDE/oxidation; MANGANESE/catalysts; SPRUCES/sulfur dioxide; OXIDATION; MANGANESE; CATALYSTS; SPRUCES; LEAVES; LEACHING

22485 (GSF–39/93, pp. 453-456) **Forest damage stocktaking in Venetia.** Dissegna, M. (Abt. fuer Forst- und Bergwirtschaft, Venezia (Italy)); Scussel, G.R. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/pathological changes; FORESTS/air pollution monitoring; FORESTS; ITALY; AIR POLLUTION

22486 (GSF–39/93, pp. 465-472) **Plant protection in the forests of the State forest (results of 1992, reference: 1990 Study).** Cenni, E. (Linnea Ambiente S.R.L., Firenze (Italy)); Bussotti, F.; Cozzi, A.; Di Girolamo, F.; Ferretti, M.; Tagliaferri, A. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Two studies on the state of the trees in the state forest in Lombardy were conducted in 1990 and 1992. Random sampling included 1620 plants distributed over a grid of 2 by 2 km in 60 areas selected for the study. Thinned canopies, discolouring and leaf curl (in decidous trees) are the most evident signs of damage. Results also show significant increas of forest damage with causes yet unknown. Total damage including plants with slight damage shows that in 1992 67% of the plants were affected, 40% show mean to strong damage. Compared to 1990 the state of the forest has definitely worsened considerably. Especially the Alps and the pre-Alpine regions are badly affected. A clear link has been established between damage intensity and some biotop parameters (quality, location). The influence of conventional causes (insects, fungi) seem to be limited. (orig./EW)

22487 (GSF–39/93, pp. 473) **Mineral content of ombrogenous peat bogs as an indicator of recent and past deposition.** Gomiscek, B. (Ecosense d.o.o., Ljublijana (Slovenia)); Kovar, A.; Batic, F.; Brancelj, A. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication TERRESTRIAL ECOSYSTEMS/air pollution; AQUATIC ECOSYSTEMS/air pollution; FORESTS/pathological changes; ATMOSPHERES; CLIMATES; YUGOSLAVIA; FORESTS

22488 (GSF–39/93, pp. 486-487) **The bioindication of sulphur in the Republic of Slowenia.** Kalan, J. (Inst. fuer Forst- und Holzwirtschaft, Ljubljana (Slovenia)). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–:

International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

Short communication FORESTS/air pollution monitoring; LEAVES/sulfur; FORESTS; SPRUCES; PINES; BIOLOGICAL INDICATORS; AIR POLLUTION; LEAVES; SULFUR; QUANTITATIVE CHEMICAL ANALYSIS; YUGOSLAVIA

22489 (GSF–39/93, pp. 499-505) **Ozone-pollution: a reason for needle loss of spruces in the higher altitudes of the Kalkalpen?.** Liu, J.C. (GSF-Forschungszentrum fuer Umwelt und Gesundheit, Expositionskammern, Neuherberg, Oberschleissheim (Germany)); Schonder, B.; Payer, H.D. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

The studies conducted for over a year with spruces in the Kalkalpen in higher altitudes of the Wank (Bavarian Kalkalpen, 1575 m nn) show that the dynamics of needle fall of green needles which come up to 522 kg/ha (TS) and account for 29% of the total needle loss correlate with frost peroids in winter and with ozone pollution in the summer. A critical boundary for the triggering of green needle drop was found if ozone concentrations above 60 ppb persist for longer than 10 hours per day (summer) or if there a relative air humidity of 60% for more than 8 hours per day is not reached (winter). The results from the summer season are seen as an indicator for needle loss caused by ozone. Participation of other factors which occur simultaneously with high ozon concentrations such as low air humidity and increased UV-radiation cannot be excluded. Winter losses of green needles are probably connected with dryness during frost periods. (orig./EW)

22490 (GSF–39/93, pp. 542-546) **Mosses as bioindicators: the ecology of elements.** Vecchi, R. (Istituto di Fisica Generale Applicata, Univ. Mailand (Italy)); Valli, G.; Gerosa, G.; Serentha, C. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU). Nov 1993. 578p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). (CONF-9304291–: International symposium on the carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries, Berchtesgaden (Germany), 27-29 Apr 1993). In *Carry-over of pollutants from the atmosphere and on forest soil pollution in the ARGE ALP and ALPEN-ADRIA countries. Proceedings.* Order Number DE95778131. Source: OSTI; NTIS (US Sales Only).

In this paper the preliminary results of a study conducted by the "Istituto di Fisica Generale Applicata", Mailand University on the determination of natural elements and pollutant elements in bioindicators is described. The technology used for analysis is energy dispersive X-ray flueorescence (EDXRF). Areas selected are: Alpine regions, Valmalenco and lower-Valtellina and urbanised areas like the hinterland of Milano and the area around Como. (orig./EW)

22491 (NEI-DK–2043) **A study of literature references on the combined effects of ozone and nitrogen dioxide.** Gehl, J. Center for Alternativ Samfundsanalyse (CASA), Copenhagen (Denmark). Jan 1995. 54p. (In Danish). Order Number DE95787792. Source: OSTI; NTIS.

A review of experimental evidence of combined effects of nitrogen dioxide (NO_2) and ozone (O_3) and of epidemiological surveys performed at levels comparable to, or below, the levels found in Copenhagen (Denmark). Short- and long-term effects were studied. Synergistic effects between O_3 and NO_2 were found with concentrations of 0.3 to 0.8 ppm O_3 and 0.3 to 14.4 ppm NO_2. Synergistic effects have been found on: Increased presence of proteins in lung lavage fluid, of inflammatory cells and epithelial cells in lung lavage fluid, increased cell division in alveoles and especially bronchioles, oxidative damages in guinea pigs and increased production of antioxidants in rats, increased activity of some enzyme systems of cell metabolism and detoxification and increased production of some prostaglandins (PgE2 and PgF2alfa). Antagonistic effects have been found on production of some prostaglandins (tromboxan A2 and PgI), and on certain cellular detoxification systems (p-450 and associated systems). An effects has been found on functions of the immune system. Epidemiological surveys showed increased morbidity due to asthma, chronic bronchitis and emphysema associated with exposure to sulphur dioxide, nitrogen dioxide and ozone. High exposure to traffic-related air pollution causes headache, dizziness, irritation of mucus membranes as well as asthma and chronic bronchitis. Increased incidence and growth of cancers is shown in animals exposed to combinations of O_3 and NO_2. The incidence of cancer especially lung cancer, is increased in Copenhagen. The increased incidence of lung cancer could not be attributed to tobacco smoking alone. The dose rate is important for the health effects of both O_3, NO_2 and a mixture of the two. Epidemilogical evidence reveals the importance of short term peaks. (AB) 44 refs.

22492 (UBA-FB–93-066) **Comparative analysis and evaluation of liver foci bioassays and their efficiency as short term screening test systems for detection of carcinogenic effects of suggested carcinogens. Final report.** Oesterle, D.; Deml, E.; Greim, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Inst. fuer Toxikologie. Jan 1992. 36p. (In German). Sponsored by Umweltbundesamt, Berlin (Germany). Contract UFOPLAN 10603059; Contract GSF-FE–77666. Order Number DE95785973. Source: OSTI; NTIS (US Sales Only).

Three rat liver foci bioassays (A, B, C), proposed for routine testing of suggested carcinogens, have been compared with respect to their efficiency as short term screening test systems. The objective was to select the most suitable assay in view of a reliable detection of initiating and promoting agents, sensitivity, expenditure of work and animals' welfare. The evaluation of dose-response relationships, measured as number and area of enzyme-deficient foci dependent on the dose, revealed that the initiation-promotion schedule using 3 weeks old female rats was most sensitive (A). Six weeks old rats and PH at the beginning followed by promotion (B) or selection (C) were less sensitive. Protocol (C) was least sensitive and impaired animals welfare strongly. The comparison included 6 initiating and 4 promoting agents. It exhibited that the most simple system (A) was most sensitive and least impairing animals' welfare. (orig.)

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 22207

22493 (UCRL-JC–120215) **Plasma mediated ablation of biological tissues with ultrashort laser pulses.** Oraevsky, A.A. (Lawrence Livermore National Lab., CA (United States)); DaSilva, L.B.; Feit, M.D. Lawrence Livermore National Lab., CA (United States). 8 Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States);Whitaker Foundation (United States). DOE Contract W-7405-ENG-48. (CONF-950226–39: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95011748. Source: OSTI; NTIS; GPO Dep.

Plasma mediated ablation of collagen gels and porcine cornea was studied at various laser pulse durations in the range from 350 fs to 1 ns at 1,053 nm wavelength. A time resolved stress detection technique was employed to measure transient stress profiles and amplitudes. Optical microscopy was used to characterize ablation craters qualitatively, while a wide band acoustic transducer helped to quantify tissue mechanical response and the ablation threshold. The ablation threshold was measured as a function of

laser pulse duration and linear absorption coefficient. For nanosecond pulses the ablation threshold was found to have a strong dependence on the linear absorption coefficient of the material. As the pulse length decreased into the subpicosecond regime the ablation threshold became insensitive to the linear absorption coefficient. The ablation efficiency was found to be insensitive to both the laser pulse duration and the linear absorption coefficient. High quality ablation craters with no thermal or mechanical damage to surrounding material were obtained with 350 fs laser pulses. The mechanism of optical breakdown at the tissue surface was theoretically investigated. In the nanosecond regime, optical breakdown proceeds as an electron collisional avalanche ionization initiated by thermal seed electrons. These seed electrons are created by heating of the tissue by linear absorption. In the ultrashort pulse range, optical breakdown is initiated by the multiphoton ionization of the irradiated medium (6 photons in case of tissue irradiated at 1,053 nm wavelength), and becomes less sensitive to the linear absorption coefficient. The energy deposition profile is insensitive to both the laser pulse duration and the linear absorption coefficient.

57 HEALTH AND SAFETY

Refer also to citation(s) 22374, 22941

22494 (DOE-STD–1088-95) **Fire protection for relocatable structures.** USDOE, Washington, DC (United States). Jun 1995. 28p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014751. Source: OSTI; NTIS; GPO Dep.

This standard supersedes DOE/EV-0043, "Standard on Fire Protection for Portable Structures." It was revised to address the numerous types of relocatable structures, such as trailers, tension-supported structures, and tents being used by DOE and contractors.

22495 (SAND–95-0320) **Qualitative methods for assessing risk.** Mahn, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Hannaman, G.W.; Kryska, P. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011834. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's (DOE) non-nuclear facilities generally require only a qualitative accident analysis to assess facility risks in accordance with DOE Order 5481.1B, Safety Analysis and Review System. Achieving a meaningful qualitative assessment of risk necessarily requires the use of suitable non-numerical assessment criteria. Typically, the methods and criteria for assigning facility-specific accident scenarios to the qualitative severity and likelihood classification system in the DOE order requires significant judgment in many applications. Systematic methods for more consistently assigning the total accident scenario frequency and associated consequences are required to substantiate and enhance future risk ranking between various activities at Sandia National Laboratories (SNL). SNL's Risk Management and National Environmental Policy Act (NEPA) Department has developed an improved methodology for performing qualitative risk assessments in accordance wi the DOE order requirements. Products of this effort are an improved set of qualitative description that permit (1) definition of the severity for both technical and programmatic consequences that may result from a variety of accident scenarios, and (2) qualitative representation of the likelihood of occurrence. These sets of descriptions are intended to facilitate proper application of DOE criteria for assessing facility risks.

22496 (UCRL-JC–120472) **Ergonomics problems and solutions in biotechnology laboratories.** Coward, T.W.; Stengel, J.W.; Fellingham-Gilbert, P. Lawrence Livermore National Lab., CA (United States). Mar 1995. 6p. DOE Contract W-7405-ENG-48. (CONF-9505214–1: Silicon Valley ergonomics conference, San Jose, CA (United States), 21-22 May 1995). Order Number DE95012221. Source: OSTI; NTIS; GPO Dep.

The multi-functional successful ergonomics program currently implemented at Lawrence Livermore National Laboratory (LLNL) will be presented with special emphasis on recent findings in the Biotechnology laboratory environment. In addition to a discussion of more traditional computer-related repetitive stress injuries and associated statistics, the presentation will cover identification of ergonomic problems in laboratory functions such as pipetting, radiation shielding, and microscope work. Techniques to alleviate symptoms and prevent future injuries will be presented.

5701 Real Accidents

Refer also to citation(s) 20740, 21240, 22306, 22309, 22422, 22426, 22433, 22438, 22445, 22447

58 GEOSCIENCES

Refer also to citation(s) 20601, 20603, 20604, 20695, 20698, 20760, 20761, 20796, 20806, 20821, 20843, 20844, 20876, 21030, 21135, 21318, 21345, 21660, 21663, 22164, 22167, 22252, 22260, 22263, 22264, 22315, 22322

22497 (ANL/ES/CP–85471) **Salinity and hydrodynamics of the Holocene and upper Pleistocene beneath the Louisiana wetlands from electrical measurements.** McGinnis, L.D. (Argonne National Lab., IL (United States)); Thompson, M.D.; Kuecher, G.J.; Wilkey, P.L.; Isaacson, H.R. Argonne National Lab., IL (United States); Gas Research Inst., Chicago, IL (United States). [1995]. 12p. Sponsored by Gas Research Inst., Chicago, IL (United States). DOE Contract W-31-109-ENG-38. (CONF-950450–9: 8. annual symposium on the application of geophysics to environmental and engineering problems, Orlando, FL (United States), 23-27 Apr 1995). Order Number DE95012284. Source: OSTI; NTIS; GPO Dep.

A conceptual hydrodynamic model in the Holocene and upper Pleistocene beneath the Louisiana wetlands is described in terms of safety distributions. Porewater safety is calculated from electrical measurements, including resistivity soundings, electric logs, and electromagnetic profiling. Electrical measurements support the primary, basin-wide groundwater flow model; however, the data also indicate secondary contributions from expulsion of fluids under geopressure along active growth faults and from original waters of deposition. Expulsion of water from growth faults has been described previously for deeper sections of the Pleistocene, but has not been reported for the Holocene or upper Pleistocene beneath the Louisiana wetlands. Porewater chemistry variations beneath the coastal wetlands are a consequence of the following (in order of importance): (1) environment of deposition; (2) a basin-wide, regional flow system; (3) expulsion from deep-seated growth faults; and (4) pore water extrusion due to compaction. Water chemistry in Holocene clays and muds is influenced primarily by the deposition environment In Pleistocene sands, the chemistry is a function of the other three factors.

22498 (BNL–61504) **A probabilistic model to liquefaction assessment of dams.** Simos, N.; Costantino, C.J.; Reich, M. Brookhaven National Lab., Upton, NY (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–44: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95008867. Source: OSTI; NTIS; GPO Dep.

In an effort to evaluate earthquake liquefaction potential of soil media, several statistical models ranging from purely empirical to mathematically sophisticated have been devised. While deterministic methods define susceptibility of a soil structure to liquefaction, for a given seismic event, in the sense that the site does or does not liquefy, probabilistic approaches incorporate statistical properties associated with both the earthquake and site characterization. In this study a stochastic model is formulated to assess liquefaction potential of soil structures in general and earth dams in particular induced by earthquakes. Such earthquakes are realizations of a random process expressed in the form of a power spectral density. Uncertainties in the soil resistance to liquefaction are also introduced with probability density functions around in-situ measurements of parameters associated with the soil strength. The attempt of this study is to devise a procedure that will lead to a continuous probability of liquefaction at a given site. Monte Carlo simulations

are employed for the probabilistic model. In addition a stochastic model is presented. The dynamic response of the two-phase medium is obtained with the help of the POROSLAM code and it is expressed in the form of a transfer function (Unit Response).

22499 (BNL-NUREG–61664) **Convolution-deconvolution in DIGES.** Philippacopoulos, A.J. (Brookhaven National Lab., Upton, NY (United States). Dept. of Advanced Technology); Simos, N. Brookhaven National Lab., Upton, NY (United States). [1995]. 9p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–43: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Source: OSTI; NTIS; INIS; GPO.

Convolution and deconvolution operations is by all means a very important aspect of SSI analysis since it influences the input to the seismic analysis. This paper documents some of the convolution/deconvolution procedures which have been implemented into the DIGES code. The 1-D propagation of shear and dilatational waves in typical layered configurations involving a stack of layers overlying a rock is treated by DIGES in a similar fashion to that of available codes, e.g. CARES, SHAKE. For certain configurations, however, there is no need to perform such analyses since the corresponding solutions can be obtained in analytic form. Typical cases involve deposits which can be modeled by a uniform halfspace or simple layered halfspaces. For such cases DIGES uses closed-form solutions. These solutions are given for one as well as two dimensional deconvolution. The type of waves considered include P, SV and SH waves. The non-vertical incidence is given special attention since deconvolution can be defined differently depending on the problem of interest. For all wave cases considered, corresponding transfer functions are presented in closed-form. Transient solutions are obtained in the frequency domain. Finally, a variety of forms are considered for representing the free field motion both in terms of deterministic as well as probabilistic representations. These include (a) acceleration time histories, (b) response spectra (c) Fourier spectra and (d) cross-spectral densities.

22500 (CONF-9310433–Absts.) **Cloud-radiation interactions and their parameterization in climate models.** National Oceanic and Atmospheric Administration, Camp Springs, MD (United States). Science Center. Nov 1994. 147p. Sponsored by USDOE, Washington, DC (United States);National Oceanic and Atmospheric Administration, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AI02-93ER61551. From Cloud-radiation interactions and their parameterization in climate models; Camp Springs, MD (United States); 18-20 Oct 1993. Order Number DE95011484. Source: OSTI; NTIS; GPO Dep.

This report contains papers from the International Workshop on Cloud-Radiation Interactions and Their Parameterization in Climate Models met on 18–20 October 1993 in Camp Springs, Maryland, USA. It was organized by the Joint Working Group on Clouds and Radiation of the International Association of Meteorology and Atmospheric Sciences. Recommendations were grouped into three broad areas: (1) general circulation models (GCMs), (2) satellite studies, and (3) process studies. Each of the panels developed recommendations on the. themes of the workshop. Explicitly or implicitly, each panel independently recommended observations of basic cloud microphysical properties (water content, phase, size) on the scales resolved by GCMs. Such observations are necessary to validate cloud parameterizations in GCMs, to use satellite data to infer radiative forcing in the atmosphere and at the earth's surface, and to refine the process models which are used to develop advanced cloud parameterizations.

22501 (DOE/ET/53088–669) **Nonlinear symmetric stability of planetary atmospheres.** Bowman, J.C. (Texas Univ., Austin, TX (United States). Inst. for Fusion Studies); Shepherd, T.G. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Nov 1994. 32p. Sponsored by USDOE, Washington, DC (United States);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada);Atmospheric Environment Service, Montreal, PQ (Canada). DOE Contract FG05-80ET53088. (IFSR–669). Order Number DE95012133. Source: OSTI; NTIS; GPO Dep.

The energy-Casimir method is applied to the problem of symmetric stability in the context of a compressible, hydrostatic planetary atmosphere with a general equation of state. Linear stability criteria for symmetric disturbances to a zonally symmetric baroclinic flow are obtained. In the special case of a perfect gas the results of Stevens (1983) are recovered. Nonlinear stability conditions are also obtained that, in addition to implying linear stability, provide an upper bound on a certain positive-definite measure of disturbance amplitude.

22502 (ES/CNPE–2) **Earthquake risk reduction in the United States: An assessment of selected user needs and recommendations for the National Earthquake Hazards Reduction Program.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Center for Natural Phenomena Engineering. 31 Dec 1994. 315p. Sponsored by USDOE, Washington, DC (United States);Federal Emergency Management Agency, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011542. Source: OSTI; NTIS; GPO Dep.

This Assessment was conducted to improve the National Earthquake Hazards Reduction Program (NEHRP) by providing NEHRP agencies with information that supports their user-oriented setting of crosscutting priorities in the NEHRP strategic planning process. The primary objective of this Assessment was to take a "snapshot" evaluation of the needs of selected users throughout the major program elements of NEHRP. Secondary objectives were to conduct an assessment of the knowledge that exists (or is being developed by NEHRP) to support earthquake risk reduction, and to begin a process of evaluating how NEHRP is meeting user needs. An identification of NEHRP's strengths also resulted from the effort, since those strengths demonstrate successful methods that may be useful to NEHRP in the future. These strengths are identified in the text, and many of them represent important achievements since the Earthquake Hazards Reduction Act was passed in 1977.

22503 (LA-SUB–95-56) **An integrated observational, experimental and computational study of plume-ridge interaction.** Gable, C.; Kincaid, C. Los Alamos National Lab., NM (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012954. Source: OSTI; NTIS; GPO Dep.

The existence of sub-horizontal channels connecting hotspot plumes and spreading ridges has been suggested by recent observationally based studies. These features have important consequences for understanding mantle dynamics and the manner in which the mantle interacts both thermally and chemically with Earth's surface. A striking result has been the importance of a sloping rheological boundary layer, resulting from the combination of variable fluid viscosity and plate spreading, in modulating channel development and evolution. Comparison of results in 2D and 3D experiments clearly indicate the limitations of 2D representations of flows which include both small scale plumes within a larger scale shear flow. 2D experiments investigate higher order physical effects such as thermochemical plumes and relative motion between plume source and ridge axis. These effects are best studied first in the more simplified 2D geometry. Experiments completed to date have significantly increased our understanding of the process of communication between plumes and ridges. This initial stage of funded research has also lead to increased interaction between observation and theory. As an example of this, Kincaid was invited to participate in a data collection cruise to Easter Island-EPR system designed to study plume-ridge interaction.

22504 (LA-UR–95-887) **Structure of the Espanola Basin, Rio Grande Rift, New Mexico, from SAGE seismic and gravity data.** Ferguson, J.F. (Univ. of Texas, Richardson, TX (United States)); Baldridge, W.S.; Braile, L.W.; Biehler, S.; Gilpin, B. Los Alamos National Lab., NM (United States). [1995]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9509119–1: 1995 New Mexico Geological Society fall field conference, Santa Fe, NM (United States), 25-29 Sep 1995). Order Number DE95009428. Source: OSTI; NTIS; GPO Dep.

Seismic and gravity data, acquired by the SAGE program over the past twelve years, are used to define the geometry of the Espanola basin and the extent of pre-Tertiary sedimentary rocks. The

Paleozoic and Mesozoic units have been thinned and removed during Laramide uplift in an area now obscured by the younger rift basin. The Espanola basin is generally a shallow, asymmetric transitional structure between deeper, better developed basins to the northeast and southwest. The gravity data indicate the presence of three narrow, but deep, structural lows arrayed along the Embudo/Pajarito fault system. These sub-basins seem to be younger than the faults on the basin margins. This apparent focussing of deformation in the later history of the basin may be a response to changes in regional stress or more local accommodation of the rift extension. Future work is planned to develop seismic data over one of these sub-basins, the Velarde graben, and to better define the gravity map in order to facilitate three-dimensional modeling.

22505 (ORNL/CDIAC–66) **Six- and three-hourly meteorological observations from 223 USSR stations.** Razuvaev, V.N. (All-Russian Research Inst. of Hydrometeorologicl Information, Obninsk (Russia). World Data Centre); Apasova, E.B.; Martuganov, R.A.; Kaiser, D.P. Oak Ridge National Lab., TN (United States). Apr 1995. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NDP–048). Order Number DE95012942. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes a database containing 6- and 3-hourly meteorological observations from a 223-station network of the former Soviet Union. These data have been made available through cooperation between the two principal climate data centers of the United States and Russia: the National Climatic Data Center (NCDC), in Asheville, North Carolina, and the All-Russian Research Institute of Hydrometeorological Information – World Data Centre (RIHMI-WDC) in Obninsk. Station records consist of 6- and 3-hourly observations of some 24 meteorological variables including temperature, weather type, precipitation amount, cloud amount and type, sea level pressure, relative humidity, and wind direction and speed. The 6-hourly observations extend from 1936 to 1965; the 3-hourly observations extend from 1966 through the mid-1980s (1983, 1984, 1985, or 1986; depending on the station). These data have undergone extensive quality assurance checks by RIHMI-WDC, NCDC, and the Carbon Dioxide Information Analysis Center (CDIAC). The database represents a wealth of meteorological information for a large and climatologically important portion of the earth's land area, and should prove extremely useful for a wide variety of regional climate change studies. These data are available free of charge as a numeric data package (NDP) from CDIAC. The NDP consists of this document and 40 data files that are available via the Internet or on 8mm tape. The total size of the database is ~2.6 gigabytes.

22506 (UCRL-JC–120952) **Can T phases be used to map blockage?.** Harris, D.; Hauk, T. Lawrence Livermore National Lab., CA (United States). May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9505222–1: 1995 monitoring technologies conference, Chantilly, VA (United States), 15-18 May 1995). Order Number DE95013309. Source: OSTI; NTIS; GPO Dep.

The placement of stations in a CTBT hydroacoustic monitoring network is controlled, in large part, by the presence of bathymetric features or land masses that block propagation. In the absence of blocking features, propagation is very efficient in the SOFAR channel, allowing surveillance over large basins with hydrophone networks that are sparse compared to seismic networks. Blockage can be estimated from theoretical calculations of acoustic attenuation. While calibration of attenuation with controlled sources is best, it is also prohibitively expensive. The T phases generated by undersea earthquakes are known to be sensitive to interruptions of the SOFAR channel. Earthquakes along ridges may illuminate regions of interest to define blockage areas. Our initial examination of T phase amplitudes suggests that T phases can be used to map blockage or other strong path attenuation. The principal difficulty to be surmounted is the ambiguity between source coupling and path attenuation. We are attempting to quantify coupling with a probabilistic model, which would permit us to estimate attenuation and to quantify the reliability of the estimate.

66 PHYSICS

6611 Classical and Quantum Mechanics

Refer also to citation(s) 21931, 22112, 22375, 22542, 22663

22507 (IC–95/70) **On the Tannaka-Artin problem.** Mahdavi Hezavehi, M. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 6p. Order Number DE95633900. Source: OSTI; NTIS (US Sales Only); INIS.

Let D be a division ring of index n over its centre F. Denote by RN(D*) and N(D*) the images of D* = D - {0} under the reduced norm functions of D to F, respectively. Algebraic properties of the Abelian factor group G(D) := D*/RN(D*)D', where D' is the derived group of D*, are investigated. It is shown that there is a group homomorphism ϕ : G(D) → H(D), where H(D) := RN(D*)/N(D*), whose kernel is a homormophic image of the reduced Whitehead group $SK_1(D)$. Using this result, it is proved that $SK_1(D) = \{1\}$ if and only if $\Omega = Z(D')$ and ϕ is an isomorphism, where Ω is the subgroup of the existing n-th roots of unity in F and Z(D') is the centre of the derived group of D*. (author). 8 refs.

22508 (IC–95/71) **On a question of Herstein concerning commutators in division rings.** Mahdavi Hezavehi, M. (International Centre for Theoretical Physics, Trieste (Italy)); Akbari Feyzaabaadi, S. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 4p. Order Number DE95633901. Source: OSTI; NTIS (US Sales Only); INIS.

Let D be a division ring with centre Z in which for all x not = 0 and y not = 0 in D, $(xyx^{-1}y^{-1})^{p(x,y)}$ is an element of Z, for some integer $p(x,y) \geq 1$, depending on x and y. Given a is an element of D such that a^s is an element of Z for some $s \geq 1$, it is shown that the minimal polynomial of a over Z is of the form $t^k - r$, where (k,6) = 1. Using this result, it is proved that if p(x,y) is of the form $2^{n(x,y)}$, then D is commutative. (author). 7 refs.

22509 (IC–95/72) **On derived groups of division rings II.** Mahdavi Hezavehi, M. (International Centre for Theoretical Physics, Trieste (Italy)); Akbari Feyzaabaadi, S.; Mehraabaadi, M.; Hajie Abolhassan, H. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 5p. Order Number DE95633902. Source: OSTI; NTIS (US Sales Only); INIS.

Let D be a division ring with centre F and denote by D' the derived group (commutator subgroup) of D* = D - {0}. It is shown that if each element of D' is algebraic over F, then D is algebraic over F. It is also proved that each finite separable extension of F in D is of the form F(c) for some element c in the derived group D'. Using these results, it is shown that if each element of the derived group D' is of bounded degree over F, then D is finite dimensional over F. (author). 5 refs.

22510 (IC–95/81) **Quantum dissipation is a dynamical collective effect.** Gruver, J.L. (International Centre for Theoretical Physics, Trieste (Italy)); Aliaga, J.; Cerdeira, H.A.; Proto, A.N. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 16p. Order Number DE95633903. Source: OSTI; NTIS (US Sales Only); INIS.

We show that the dissipative dynamics observed in a small quantum system coupled to a large one (the bath) is a consequence of increasing the size of the bath. We exemplify this effect with a quantum harmonic oscillator coupled to N harmonic oscillators. We find that revivals in the level population exists and give an estimate of their period. For large values of N, the level population decays exponentially coming into thermal equilibrium. We conclude that quantum dissipation is a dynamical collective effect. Finally, we discuss extensions beyond the harmonic oscillator. (author). 31 refs, 2 figs.

22511 (JINR-E–4-94-123, pp. 124) **New situation in quantum mechanics.** Zakhariev, B.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of*

abstracts. Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. QUANTUM MECHANICS/energy levels; RESONANCE

22512 (JINR-R–2-94-150, pp. 48-53) **Nonradiating distributions of currents and charges periodically varying in time.** Afanas'ev, G.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

Charge and current densities are determined periodically varying in time and located in the final area of S space and possessing the property that electromagnetic potentials disappear beyond S. The conditions under which this phenomenon takes place are found. 10 refs.

22513 (JINR-R–2-94-150, pp. 153-157) **Elliptically deformed classical mechanics in three-dimensional phase space.** Yamaleev, R.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

Basic concepts of classical mechanics in 3 D phase space which can be interpreted as elliptically deformed Newton mechanics are formulated. It is shown that the Nam bu equations play the role of Hamilton dynamic equations for the deformed mechanics. 7 refs.

22514 (LAMP–95/3) **Down-conversion processes and the parametric approximation.** LAMP Series Report (Laser, Atomic and Molecular Physics), LAMP Series Report (Laser, Atomic and Molecular Physics). Mogilevtsev, D. International Centre for Theoretical Physics, Trieste (Italy). Apr 1995. 8p. Grant FI19/203. Order Number DE95633904. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the applicability of the parametric approximation to the processes of photon down-conversion depends on the value of frequency detuning between pump and signal field modes. It is found that for the multi-photon down-version processes the threshold value of detuning exists. If the detuning is smaller than the threshold value the behavior of the average number of photons in signal mode has a singular character in this approximation due to inapplicability of the parametric approximation in this case. (author). 4 refs, 2 figs.

6612 Techniques of General Use in Physics

Refer also to citation(s) 21780, 22010

22515 (INIS-RU–405, pp. 217-222) **On polarization effects in crystals.** Baryshevskij, V.G. (Belorusskij Gosudarstvennyj Univ., Minsk (Belarus)); Tikhomirov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The last results of Monte Carlo modelling of e^+ radiative self-polarization in bend crystals evidenced on real possibility of using this effect for transverse polarization of e^+- beams in TeV range. New suggestion on crystals using for production and analysis of polarized proton beams at TeV acceleration are discussed. 3 refs.; 3 figs.

22516 (LA-UR–95-1540) **Phase-scan analysis results for the first drift tube linac module in the ground test accelerator: Data reproducibility and comparison to simulations.** Johnson, K.F. (and others); Sander, O.R.; Bolme, G.O. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by Department of the Army, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–145: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011981. Source: OSTI; NTIS; INIS; GPO Dep.

The Ground Test Accelerator (GTA) had the objective of producing a high-brightness, high-current H- beam. The major accelerator components were a 35 keV injector, a Radio Frequency Quadrupole, an intertank matching section, and a drift tube linac (DTL), consisting of 10 modules. This paper discusses the phase-scan technique which was used to experimentally determine the rf operating parameters for the commissioning and routine operation of the first DTL module.

22517 (LBL–36132) **Radiation and gas conduction heat transport across a helium dewar multilayer insulation system.** Green, M.A. Lawrence Berkeley Lab., CA (United States). 10 Oct 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95012324. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a method for calculating mixed heat transfer through the multilayer insulation used to insulate a 4 K liquid helium cryostat. The method described here permits one to estimate the insulation potential for a multilayer insulation system from first principles. The heat transfer regimes included are: radiation, conduction by free molecule gas conduction, and conduction through continuum gas conduction. Heat transfer in the transition region between the two gas conduction regimes is also included.

6613 Other Aspects of Physical Science

Refer also to citation(s) 21555, 21843, 22113, 22144, 22245, 22769, 22844

22518 (ANL/MCS/CP–84761) **Parallel molecular dynamics: Communication requirements for massively parallel machines.** Taylor, V.E. (Northwestern Univ., Evanston, IL (United States). Dept. of Electrical Engineering and Computer Science); Stevens, R.L.; Arnold, K.E. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9502101–2: Frontiers 95: a workshop on future directions of massively parallel processing, McLean, VA (United States), 6-9 Feb 1995). Order Number DE95012948. Source: OSTI; NTIS; GPO Dep.

Molecular mechanics and dynamics are becoming widely used to perform simulations of molecular systems from large-scale computations of materials to the design and modeling of drug compounds. In this paper we address two major issues: a good decomposition method that can take advantage of future massively parallel processing systems for modest-sized problems in the range of 50,000 atoms and the communication requirements needed to achieve 30 to 40% efficiency on MPPs. We analyzed a scalable benchmark molecular dynamics program executing on the Intel Touchstone Deleta parallelized with an interaction decomposition method. Using a validated analytical performance model of the code, we determined that for an MPP with a four-dimensional mesh topology and 400 MHz processors the communication startup time must be at most 30 clock cycles and the network bandwidth must be at least 2.3 GB/s. This configuration results in 30 to 40% efficiency of the MPP for a problem with 50,000 atoms executing on 50,000 processors.

22519 (ANL/MCS/CP–85304) **Computational electromagnetics and parallel dense matrix computations.** Forsman, K. (Tampere Univ. of Technology (Finland)); Kettunen, L.; Gropp, W.; Levine, D. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). (CONF-950212–8: 7. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing, San Francisco, CA (United States), 15-17 Feb 1995). Order Number DE95012286. Source: OSTI; NTIS; GPO Dep.

We present computational results using CORAL, a parallel, three-dimensional, nonlinear magnetostatic code based on a volume integral equation formulation. A key feature of CORAL is the ability to solve, in parallel, the large, dense systems of linear equations that are inherent in the use of integral equation methods.

Using the Chameleon and PSLES libraries ensures portability and access to the latest linear algebra solution technology.

22520 (DOE/ER/13916–T3) **Turbulence and spatio-temporal chaos. Final Report.** Jayaprakash, C.; Hayot, F. Ohio State Univ., Columbus, OH (United States). Dept. of Physics. [1995]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13916. Order Number DE95012912. Source: OSTI; NTIS; GPO Dep.

Turbulence phenomena encompass many behaviors at many scales, from chaotic behavior at small scales to coherent structures at large scales. The crucial question is how different scales interact. We have sought clues to a general answer by raising the following questions: Can a deterministic chaotic system described by a determininstic partial differential equation (the Kuramoto-Sivashinsky equation) be characterized at large scales by the same static and dynamic scaling exponents that determine a stochastic equation (the Kardar-Parisi-Zhang equation)? Through an extensive numerical study in both one and two dimensions we have concluded that truly, on large scales, the Kuramoto-Sivashinsky and Kardar-Parisi-Zhang equations belong to the same universality class. The procedure (pioneered by Zaleski) involves coarse graining in Fourier space. Through a detailed analysis of its features, and in particular the effective noise-noise correlation, we are able to comprehend the magnitudes of the physical parameters, and in particular estimate the cross-over times from free to interacting behavior.

22521 (DOE/ER/40561–194) **Kaon condensation in dense stellar matter.** Lee, Chang-Hwan (Seoul National Univ. (Korea, Republic of)); Rho, M. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Mar 1995. 30p. Sponsored by USDOE, Washington, DC (United States);Korea Ministry of Education (Korea). DOE Contract FG06-90ER40561. G bsri-94-2418. Order Number DE95012175. Source: OSTI; NTIS; INIS; GPO Dep.

This article combines two talks given by the authors and is based on Works done in collaboration with G.E. Brown and D.P. Min on kaon condensation in dense baryonic medium treated in chiral perturbation theory using heavy-baryon formalism. It contains, in addition to what was recently published, astrophysical backgrounds for kaon condensation discussed by Brown and Bethe, a discussion on a renormalization-group analysis to meson condensation worked out together with H.K. Lee and S.J. Sin, and the recent results of K.M. Westerberg in the bound-state approach to the Skyrme model. Negatively charged kaons are predicted to condense at a critical density $2 \lesssim \rho/\rho o \lesssim 4$, in the range to allow the intriguing new phenomena predicted by Brown and Bethe to take place in compact star matter.

22522 (DOE/ER/45378–T5) **Applications of mesoscopic physics to novel correlations and fluctuations of speckle patterns: Imaging and tomography with multiply scattered classical waves. Final report.** Feng, Shechao Charles. California Univ., Los Angeles, CA (United States). Dept. of Physics. Feb 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER45378. Order Number DE95014759. Source: OSTI; NTIS; GPO Dep.

This is the final report on the grant, entitled 'applications of mesoscopic physics to novel correlations and fluctuations of speckle patterns: imaging and tomography with multiply scattered classical waves', which expired on September 14, 1994. The author summarizes the highlights of this research program, and lists the publications supported by this grant. The report is divided into sections, titled: application of mesoscopic fluctuations theory to correlations and fluctuations of multiply scattered light; quantum transport in localized electronic systems; electron-phonon inelastic scattering rate and the temperature scaling exponent in integer quantum Hall effect; high frequency quantum transport in quantum well devices.

22523 (DOE/ET/53088–706) **Sinuous oscillations and steady warps of polytropic disks.** Balmforth, N.J. (Texas Univ., Austin, TX (United States). Fusion Research Center); Spiegel, E.A. Texas Univ., Austin, TX (United States). Fusion Research Center. May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–706). Order Number DE95013473. Source: OSTI; NTIS; INIS; GPO Dep.

In an asymptotic development of the equations governing the equilibria and linear stability of rapidly rotating polytropes we employed the slender aspect of these objects to reduce the three-dimensional partial differential equations to a somewhat simpler, ordinary integro-differential form. The earlier calculations dealt with isolated objects that were in centrifugal balance, that is the centrifugal acceleration of the configuration was balanced largely by self gravity with small contributions from the pressure gradient. Another interesting situation is that in which the polytrope rotates subject to externally imposed gravitational fields. In astrophysics, this is common in the theory of galactic dynamics because disks are unlikely to be isolated objects. The dark halos associated with disks also provide one possible explanation of the apparent warping of many galaxies. If the axis of the highly flattened disk is not aligned with that of the much less flattened halo, then the resultant torque of the halo gravity on the disk might provide a nonaxisymmetric distortion or disk warp. Motivated by these possibilities we shall here build models of polytropic disks of small but finite thickness which are subjected to prescribed, external gravitational fields. First we estimate how a symmetrical potential distorts the structure of the disk, then we examine its sinuous oscillations to confirm that they freely decay, hence suggesting that a warp must be externally forced. Finally, we consider steady warps of the disk plane when the axis of the disk does not coincide with that of the halo.

22524 (FNAL/C–95/065) **Software engineering methods and standards used in the sloan digital sky survey.** Petravick, D. (Fermi National Accelerator Lab., Batavia, IL (United States)); Berman, E.; Gurbani, V.; Nicinski, T.; Pordes, R.; Rechenmacher, R.; Sergey, G.; Lupton, R.H. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States);Sloan (Alfred P.) Foundation, New York, NY (United States). DOE Contract AC02-76CH03000. (CONF-9504108–1: 4. international workshop on software engineering, artificial intelligence and expert systems for high-energy and nuclear physics, Pisa (Italy), 3-8 Apr 1995). Order Number DE95013239. Source: OSTI; NTIS; GPO Dep.

We present an integrated science software development environment, code maintenance and support system for the Sloan Digital Sky Survey (SDSS) now being actively used throughout the collaboration. The SDSS is a collaboration between the Fermi National Accelerator Laboratory, the Institute for Advanced Study, The Japan Promotion Group, Johns Hopkins University, Princeton University, The United States Naval Observatory, the University of Chicago, and the University of Washington. The SDSS will produce a five-color imaging survey of 1/4 of the sky about the north galactic cap and image 10^8 Stars, 10^8 galaxies, and 10^5 Quasars. Spectra will be obtained for 10^6 galaxies and 10^5 Quasars as well. The survey will utilize a dedicated 2.5 meter telescope at the Apache Point Observatory in New Mexico. Its imaging camera will hold 54 Charge-Coupled Devices (CADS). The SDSS will take five years to complete, acquiring well over 12 TB of data.

22525 (IC–95/21) **Tangent cones at infinity under quadratic sectional curvature decay.** Pacelli Bessa, G. (International Centre for Theoretical Physics, Trieste (Italy)); Marenich, V. International Centre for Theoretical Physics, Trieste (Italy). Feb 1995. 8p. Order Number DE95633918. Source: OSTI; NTIS (US Sales Only); INIS.

We consider limits in the Hausdorff-Gromov metrics of sequences of pointed open manifolds of non-negative Ricci curvature of special type, called Tangent Cones at Infinity. Under an assumption of quadratic sectional curvature decay we prove some rigidity and structure theorems, giving in particular an affirmative answer to conjectures by M. Anderson and T. Yamaguchi. (author). 11 refs.

22526 (IC–95/26) **Haldane's statistical interactions and universal properties of anyon systems.** Protogenov, A. International Centre for Theoretical Physics, Trieste (Italy). Mar 1995. 9p. Grant 95-02-05620; 94-31-4-20. Order Number DE95633919. Source: OSTI; NTIS (US Sales Only); INIS.

The exclusion principle of fractional statistics proposed by Haldane is applied to systems with internal degrees of freedom. The symmetry of these systems is included in the statistical interaction

matrix which contains the Cartan matrix of Lie algebras. The solutions of the equations for the statistical weights, which coincide with the thermodynamic Bethe ansatz equations are determined in the high temperature limit by the squares of q-deformed dimensions of irreducible representations. The entropy and other thermodynamic properties of anyon systems in this limit are completely characterized by the algebraic structure of symmetry in the universal form. (author). 39 refs.

22527 (IC–95/79) **Sobolev imbedding theorems for degenerate metrics.** Nguyen Minh Tri. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 10p. Order Number DE95633920. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the paper is to point out some similar properties for the Laplace's equation in R^n ($n \geq 3$) and the hypoelliptic equation in R^2 ($k \geq 1$). 11 refs.

22528 (JINR-R–2-94-150, pp. 115-120) **Correlation analysis of extremely low-frequency variations of the natural electromagnetic Earth field and the problem of detecting periodical gravitational radiation.** Balakin, A.B. (Kazanskij Univ, Kazan (Russian Federation)); Murzakhanov, Z.G.; Grunskaya, L.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves*. Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

A proposal on the experimental detection of extremely low-frequency variations of the electromagnetic Earth field at the gravitational-wave frequency and method for correlation processing results of the experiments are described. 14 refs.

22529 (LA-SUB–95-55) **Interface deformation in low reynolds number multiphase flows: Applications to selected problems in geodynamics.** Gable, C. (Los Alamos National Lab., NM (United States)); Travis, B.J.; O'Connell, R.J.; Stone, H.A. Los Alamos National Lab., NM (United States); Harvard Univ., Cambridge, MA (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012953. Source: OSTI; NTIS; GPO Dep.

Flow in the mantle of terrestrial planets produces stresses and topography on the planet's surface which may allow us to infer the dynamics and evolution of the planet's -interior. This project is directed towards understanding the relationship between dynamical processes related to buoyancy-driven flow and the observable expression (e.g. earthquakes, surface topography) of the flow. Problems considered include the ascent of mantle plumes and their interaction with compositional discontinuities, the deformation of subducted slabs, and effects of lateral viscosity variations on post-glacial rebound. We find that plumes rising from the lower mantle into a lower-viscosity upper mantle become extended vertically. As the plume spreads beneath the planet's surface, the dynamic topography changes from a bell-shape to a plateau shape. The topography and surface stresses associated . with surface features called arachnoids, novae and coronae on Venus are consistent with the surface expression of a rising and spreading buoyant volume of fluid. Short wavelength viscosity variations, or sharp variations of lithosphere thickness, have a large effect on surface stresses. This study also considers the interaction and deformation of buoyancy-driven drops and bubbles in low Reynolds number multiphase systems. Applications include bubbles in magmas, the coalescence of liquid iron drops during core formation, and a wide range of industrial applications. Our methodology involves a combination of numerical boundary integral calculations, experiments and analytical work. For example, we find that for deformable drops the effects of deformation result in the vertical alignment of initially horizontally offset drops, thus enhancing the rate of coalescence.

22530 (LA-SUB–95-58) **The confirmation of the 2.1 ms candidate for PSR1987A and the 1000-hour Arecibo Piggyback ms Pulsar Survey. Final report.** Middleditch, J. (Los Alamos National Lab., NM (United States)); Kulkarni, S. Los Alamos National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012955. Source: OSTI; NTIS; GPO Dep.

The authors objectives included (1) The confirmation of the 2.1 ms candidate for the pulsar (PSR1987A) in Supernova 1987A (SN1987A), and, provided the candidate is real (and if it is real, the authors have successfully tracked its frequency for two years), (2) to determine the nature of its spindown, including whether it is a result of gravitational radiation (GR), inertia transfer associated with differential rotation, changes in the moment of inertia, or the affects of a wide binary system. The authors have decent results to support the supposition that the spindown of this candidate for PSR1987A is indeed due almost entirely to gravitational radiation. The observations with the University of Tasmania 1-m telescope were successful in detecting the 2.1 ms candidate pulsar on at least three occasions. They can conclude that there is now little doubt that SN1987A was the result of a merger of two giant stars which resulted in: (1) The ejection of the three rings during a common-envelope/Roche lobe overflow phase which may have lasted only 300 to 1,000 years some 30,000 years ago, (2) The extreme mixing of the elements during the spiraling in phase of the two ~0.7 solar mass white dwarf cores, (3) The blue supergiant nature of the progenitor star, Sk-69 202, and (4) the formation of a weak-field ms pulsar spinning every 2.1 ms. The importance of this finding is nearly inestimable. The authors now know that neutron stars can sustain or grow oblatenesses of 5 parts in ten million some 5-7 years after their explosive birth, and that pulsars born in such a way can outshine all other compact solar mass type objects by an order of magnitude in nearly pure gravitational radiation. They know now that most weak field ms, pulsars are born in such core mergers, which explains their drastic overabundance in the globular clusters relative to the low mass X-ray binaries, which were previously, and erroneously thought of as their progenitors.

22531 (SSCL–469) **Geometric phases in self-induced transparency.** Sen, T. (Superconducting Super Collider Lab., Dallas, TX (United States)); Milovich, J. Superconducting Super Collider Lab., Dallas, TX (United States). May 1991. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011143. Source: OSTI; NTIS; INIS; GPO Dep.

We consider the geometric phases arising in the lossless propagation of light pulses through a medium composed of near resonant two-level atoms. A reformulation of the coupled Maxwell-Schroedinger equations allows us to construct conservation laws in a general context. There exist periodic solutions of these equations which lead to the possibility of cyclical evolution of the state vector and the appearance of a geometric phase. We first show that if the ground state is the initial state of the system, then it acquires a geometric phase after the passage of the soliton pulses of McCall and Hahn. More generally if the initial state is a superposition of the two levels, continuous pulse trains can propagate without appreciable loss. We also find in this case that the state vector develops a geometric phase provided the parameters take on the particular values required for cyclical evolution. In both cases we exhibit the geometric character of the calculated phases by showing that they equal half the solid angle subtended by a closed curve traced by the Bloch, vector on the Bloch sphere. We verify a recent assertion of Anandan and Aharonov that the energy uncertainty in the state is directly related to the speed at which the tip of the Bloch vector moves along the curve on the Bloch sphere (or in more general terms the energy uncertainty is related to the speed in the projective Hilbert space).

22532 (SSCL–539) **High frequency breakdown voltage.** Chu, Thanh Duy. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011146. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains information about the effect of frequency on the breakdown voltage of an air gap at standard pressure and temperature, 76 mm Hg and O°C, respectively. The frequencies of interest are 47 MHz and 60 MHz. Additionally, the breakdown in vacuum is briefly considered. The breakdown mechanism is explained on the basis of collision and ionization. The presence of the positive ions produced by ionization enhances the field in the gap, and thus determines the breakdown. When a low-frequency voltage is applied across the gap, the breakdown mechanism is

the same as that caused by the DC or static voltage. However, when the frequency exceeds the first critical value f_c, the positive ions are trapped in the gap, increasing the field considerably. This makes the breakdown occur earlier; in other words, the breakdown voltage is lowered. As the frequency increases two decades or more, the second critical frequency, f_{ce}, is reached. This time the electrons start being trapped in the gap. Those electrons that travel multiple times across the gap before reaching the positive electrode result in an enormous number of electrons and positive ions being present in the gap. The result is a further decrease of the breakdown voltage. However, increasing the frequency does not decrease the breakdown voltage correspondingly. In fact, the associated breakdown field intensity is almost constant (about 29 kV/cm).The reason is that the recombination rate increases and counterbalances the production rate, thus reducing the effect of the positive ions' concentration in the gap. The theory of collision and ionization does not apply to the breakdown in vacuum. It seems that the breakdown in vacuum is primarily determined by the irregularities on the surfaces of the electrodes. Therefore, the effect of frequency on the breakdown, if any, is of secondary importance.

22533 (SSCL-Preprint–554) **Dissipative model for a two component gas system with friction.** Lopez, G. (Superconducting Super Collider Lab., Dallas, TX (United States)); Murgia, M.; Sosa, M. Superconducting Super Collider Lab., Dallas, TX (United States). Feb 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011157. Source: OSTI; NTIS; INIS; GPO Dep.

For a mixture of small and large component of gases, the large component is treated as an ideal gas. A dissipative model is proposed for the small component, and the thermodynamic characteristics of the gas are derived through a statistical mechanical approach. The model requires for the small component to have a big dimension and its number of particles to be smaller than the large one. Using the associated partition function, the internal energy and the equation of state are calculated. The internal energy does not suffer any deviation from that of the two component ideal gas, but the equation of state deviates from that of the ideal gas for large values of the parameter which characterizes the dissipative model.

22534 (UCRL-JC–119032) **The OPAL opacity code: New results.** Rogers, F.J.; Iglesias, C.A. Lawrence Livermore National Lab., CA (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9408236–1: Astronomical Society of the Pacific conference, Hague (Netherlands), 15-27 Aug 1994). Order Number DE95011729. Source: OSTI; NTIS; GPO Dep.

The OPAL code was developed to calculate the wide range of frequency-dependent and mean opacity data needed to model laboratory experiments and stellar interiors. We use parametric potentials to generate vastly more atomic data than used in earlier opacity work for all elements with atomic number less than 35. We have also developed an improved equation of state based on an activity expansion of the grand canonical partition function. We give herein a brief description of the OPAL code and present new results that include the effect of additional heavy elements compared to our earlier carbons. The importance of very heavy elements having atomic number greater than 30 is also discussed. We present some comparisons with recent results from the Opacity Project and some directions for future work.

22535 (UCRL-JC–120557) **ORFEUS and EUVE observations of AM herculis.** Mauche, C.W. (Lawrence Livermore National Lab., CA (United States)); Paerels, F.B.S.; Raymond, J.C. Lawrence Livermore National Lab., CA (United States). 6 Apr 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950189–1: ASP conference: Cape workshop on magetic cataclysmic variables, Cape Town (South Africa), 23-25 Jan 1995). Order Number DE95012456. Source: OSTI; NTIS; GPO Dep.

Far-UV spectra of AM Her in a high optical state were obtained in 1993 September with the University of California, Berkeley (UCB) spectrometer aboard the ORFEUS telescope. The UCB spectrometer has a spectral resolution $\lambda/\Delta\lambda$ 3000 and covers the 390-1170 Å bandpass, but interstellar absorption leaves no detectable -flux below the Lyman limit. Spectra of AM Her were acquired during the intervals 04:19:40-04:36:26 UT on September 16 and 08:34:03-09:09:06 UT on September 17 of 1993. The corresponding magnetic phases are 0.75-0.84 and 0.88-1.07 according to the linear polarization ephemeris of S. Tapia. The main spectral features are the O VI doublet, C III λ977, and He II λ1085 (Balmer γ). The bright C III λ1176 multiplet, which is detected by IUE, is at the very end of the spectrum. At the full spectral resolution of the instrument, the O VI doublet shows broad and narrow components similar to that of the optical emission lines. The intensity ratio of the narrow component of the O VI doublet is $\sim$ 1.3:1, much closer to the optically thick limit of 1:1 than the optically thin ratio of 2:1.

22536 (UCRL-LR–118510) **High order harmonic generation in rare gases.** Budil, K.S. Lawrence Livermore National Lab., CA (United States). 1 May 1994. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012454. Source: OSTI; NTIS; GPO Dep.

The process of high order harmonic generation in atomic gases has shown great promise as a method of generating extremely short wavelength radiation, extending far into the extreme ultraviolet (XUV). The process is conceptually simple. A very intense laser pulse (I $\sim 10^{13}$-10^{14} W/cm^2) is focused into a dense ($\sim 10^{17}$ particles/cm^3) atomic medium, causing the atoms to become polarized. These atomic dipoles are then coherently driven by the laser field and begin to radiate at odd harmonics of the laser field. This dissertation is a study of both the physical mechanism of harmonic generation as well as its development as a source of coherent XUV radiation. Recently, a semiclassical theory has been proposed which provides a simple, intuitive description of harmonic generation. In this picture the process is treated in two steps. The atom ionizes via tunneling after which its classical motion in the laser field is studied. Electron trajectories which return to the vicinity of the nucleus may recombine and emit a harmonic photon, while those which do not return will ionize. An experiment was performed to test the validity of this model wherein the trajectory of the electron as it orbits the nucleus or ion core is perturbed by driving the process with elliptically, rather than linearly, polarized laser radiation. The semiclassical theory predicts a rapid turn-off of harmonic production as the ellipticity of the driving field is increased. This decrease in harmonic production is observed experimentally and a simple quantum mechanical theory is used to model the data. The second major focus of this work was on development of the harmonic "source". A series of experiments were performed examining the spatial profiles of the harmonics. The quality of the spatial profile is crucial if the harmonics are to be used as the source for experiments, particularly if they must be refocused.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 21880

22537 (SSC–250-Rev.) **Report of the Ad Hoc Committee on SSC physics.** Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1990. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011177. Source: OSTI; NTIS; INIS; GPO Dep.

The Ad Hoc Committee on SSC Physics has reexamined the relationship between beam energy, machine luminosity, and physics capability. In the next section, the physics motivation for the SSC is reviewed in general terms. This is followed by a discussion of the ability to detect a number of specific processes as a function of the SSC energy and luminosity. The viability of various detector technologies is then assessed as a function of luminosity. The report ends with a brief summary and some conclusions.

22538 (SSCL–412) **CA/CPS: A Communications ZEBRA implementation using CPS.** Roberts, L.A. Superconducting Super Collider Lab., Dallas, TX (United States). May 1991. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011141. Source: OSTI; NTIS; INIS; GPO Dep.

CZ/CPS is an implementation of the Communications ZEBRA distributed computing environment utilizing the CPS communications protocol. CZ/CPS is intended for parallelization of high energy

physics application programs using the CERN Program Library memory and data structure management features. CZ/CPS provides transparent communication of ZEBRA data structures among cooperative processes using standard interfaces for ZEBRA I/O. Examples of usage in a CPS HBOOK4 and GEANT3 application are provided.

22539 (SSCL–495) **Meeting the information needs of high energy physicists.** Kreitz, P. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011181. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. HIGH ENERGY PHYSICS/information retrieval; INFORMATION SYSTEMS; SUPERCONDUCTING SUPER COLLIDER

6621 General Theory of Particles and Fields

Refer also to citation(s) 22525, 22561, 22631, 22634, 22635, 22637, 22640, 22800

22540 (ANL-HEP-CP–94-79) **Scale-invariant Lipatov kernels from t-channel unitarity.** Coriano, C.; White, A.R. Argonne National Lab., IL (United States). 14 Nov 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9409257–2: 24. international symposium on multiparticle dynamics, Vietri sul Mare (Italy), 12-19 Sep 1994). Order Number DE95004625. Source: OSTI; NTIS; INIS; GPO Dep.

The Lipatov equation can be regarded as a reggeon Bethe-Salpeter equation in which higher-order reggeon interactions give higher-order kernels. Infra-red singular contributions in a general kernel are produced by t-channel nonsense states and the allowed kinematic forms are determined by unitarity. Ward identity and infra-red finiteness gauge invariance constraints then determine the corresponding scale-invariant part of a general higher-order kernel.

22541 (IC–95/63) **On the geometry of large-scale distribution of galaxies (spontaneous violation of the cosmological principle).** Budinich, P. (International Centre for Theoretical Physics, Trieste (Italy)); Nurowski, P.; Raczka, R.; Ramella, M. International Centre for Theoretical Physics, Trieste (Italy). Apr 1995. 8p. (ILAS/FM–9/1994.). Order Number DE95631723. Source: OSTI; NTIS (US Sales Only); INIS.

Recent observations on the distribution of galaxies in the universe have revealed large-scale structures whose origin seems difficult to explain in the frame of most cosmological theories. The most famous is the Great Wall: a $\approx$50 by $\approx$100 Mpc/h-structure (where $h \simeq 0.5 - 1$) is Hubble's constant in units of 100 km.s^{-1} Mpc^{-1} discovered in 1989 at a distance of $\approx$80 Mpc/h in the northern hemisphere. The most recent is the South Wall, discovered recently, slightly nearer to us, in the southern hemisphere. Further observations, known as pencil-beam surveys, have revealed in 1990 and confirmed later correlations in galaxy distributions with a periodicity of 128 Mpc/h in some particular directions (N-S Galactic poles). The main interest of these large-scale structures lies in the fact they cannot be ascribed to gravitation. Therefore they might represent unexpected violations of the Cosmological Principle (stating: "the spatial isotropy and uniformity of the universe"). Here we propose a simple model, based on a wave equation which foresees eigenvibrations of a Robertson-Walker universe. Just one of these allows reproduction of the main features of most of the observed large-scale structures. It also allows predictions of wave-structures in the distribution of galaxies at large distances which, if observed (or not) could represent a proof (or a disproof) of the model. In this case the observed structured would represent a natural violation of the Cosmological principle: one of those well known in physics with the name "spontaneous" symmetry breaking. (author). 15 refs, 4 figs.

22542 (IC–95/68) **Stationary solutions of the Maxwell-Dirac and the Klein-Gordon-Dirac equations.** Esteban, M.J. (Paris Dauphine Univ., Paris (France). CEREMADE (URA CNRS 749)); Georgiev, V.; Sere, E. International Centre for Theoretical Physics, Trieste (Italy). 1995. 22p. Order Number DE95633928. Source: OSTI; NTIS (US Sales Only); INIS.

The Maxwell-Dirac system describes the interaction of an electron with its own electromagnetic field. We prove the existence of soliton-like solutions of Maxwell-Dirac in (3+1)-Minkowski space-time. The solutions obtained are regular, stationary in time, and localized in space. They are found by a variational method, as critical points of an energy functional. This functional is strongly indefinite and presents a lack of compactness. We also find soliton-like solutions for the Klein-Gordon-Dirac system, arising in the Yukawa model. (author). 32 refs.

22543 (JINR-R–2-94-150, pp. 3-13) **Gravitation theory with field metrics and background connection.** Chernikov, N.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

In the region of the Lobachevsky velocity space are introduced coordinates connected with particle velocity components and momentum components of a particle with unit mass of rest. The Lobachevsky geometry is introduced in the determination of background connection. 8 refs.

22544 (JINR-R–2-94-150, pp. 21-26) **Numerical estimations of the Lobachevsky constant in the Chernikov gravity theory on the base of astronomical observations.** Alekseev, S.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

In the gravity theory with two connection are obtained numerical estimations for the Lobachevsky constant for a case when the background connection is determined by the Lobachevsky geometry. 15 refs.

22545 (JINR-R–2-94-150, pp. 27-32) **Energy density of the gravitational field with a concentrated mass in the relativity theory with gravity and background connection determined by the Lobachevsky geometry.** Asanov, R.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

An expression is obtained for the energy-momentum density tensor of the gravitational field within the frameworks of the general relativity theory. A case is considered when the tensor depends only on the background connection and the theory is determined by two connections given by the Lobachevsky geometry. 11 refs.

22546 (JINR-R–2-94-150, pp. 39-47) **Metrics of a 'mole hole' against the Lobachevsky space background.** Tentyukov, M.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

'Classical' mole hole are the Euclidean metrics consisting of two large space regions connected by a throat. They are the instanton solutions of the Einstein equations. It is shown that for existence of mole holes in the general relativity theory it is required the energy-momentum tensor breaking energetic conditions. 9 refs., 7 figs.

22547 (JINR-R–2-94-150, pp. 60-70) **Conservation laws in the general relativity theory (GRT).** Konopleva, N.P. (Vserossijskij Nauchno-Issledovatel'skij Inst Ehlektromekhaniki, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna

(Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

The structure is discussed of differential and integral conservation laws in GRT as a particular case of the general for all gauge fields structure of the conservation laws determined by the second Nether theorem. The type of the conservation laws is compared with the generally accepted in the elementary particle physics conservation laws following the first Nether theorem. 8 refs., 2 tabs., 2 figs.

22548 (JINR-R-2-94-150, pp. 77-83) **Classical and quantized fields in a multiconical space-time.** Gal'tsov, D.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation)); Grats, Yu.V.; Lavrent'ev, A.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that in a multiconical space the Euclidean Green function and its derivatives have nonzero values in the limit of coinciding points. In the first order of the perturbation theory is correct the superposition principle, i.e. contributions from different string are added. Beyond the frameworks of the approximation is found the effect of string vacuum interaction. 19 refs.

22549 (JINR-R-2-94-150, pp. 84-87) **Conformal momentum and Lie derivative of spinor field in Riemann space.** Stepanov, V.E. (Yakutskij Gosudarstvennyj Univ, Yakutsk (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

It is proven that in Riemann space-time the conformal momentum and the derivative of Lie spinors differ in the contribution which contains multiplication by a multiplier from Killing conformal equations. 2 refs.

22550 (JINR-R-2-94-150, pp. 97-102) **Background connection and Lagrange formalism.** Koryukin, V.M. (Marijskij Politekhnicheskij Inst, Ioshkar-Ola (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that it is necessary to introduce background connection to describe a nontrivial vacuum structure in any theory of interactions. Background connection may not depend on geometrization of interactions. 7 refs.

22551 (JINR-R-2-94-150, pp. 103-107) **Vacuum in covariant theory of gauge fields.** Koryukin, V.M. (Marijskij Politekhnicheskij Inst, Ioshkar-Ola (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

Gauge field equations are derived for a Lagrangian in the space of affine connection M_4. The solutions to these equations can only describe the ground state of the Universe. 3 refs.

22552 (JINR-R-2-94-150, pp. 133-140) **Polynomialization of the Einstein-Gilbert and the problem of the gravitational field energy-momentum.** Leonovich, A.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

A new approach in the relativistic gravitation theory is proposed. It is established that the Gilbert energy-momentum tensor for dynamic torsion has the Yang-Mills form on the equations of motion. The problem of energy-momentum for tensor gauge fields of the Yang-Mills type is solved. 12 refs.

22553 (JINR-R-2-94-150, pp. 146-152) **Vacuum model of strong interactions. New results.** Gubarev, E.A. (AO 'Vakuumno-Inertsionnye Tekhnologii', Moscow (Russian Federation)); Sidorov, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435--: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

The principal concepts of strong-interaction model based on the exact solutions of vacuum equations are formulated. Mathematical tools applied to quantum theory of scattering in the NUT field are reported. New theoretical results are presented, theoretical and experimental data are compared. Some anomalous effects in high-energy spin physics are explained qualitatively. 17 refs., 1 fig.

22554 (LA-UR-95-1375) **Nonequilibrium problems in quantum field theory and Schwinger's closed time path formalism.** Cooper, F. Los Alamos National Lab., NM (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950299--1: International symposium on unified symmetry: in the small and in the large, Miami, FL (United States), 2-5 Feb 1995). Order Number DE95012056. Source: OSTI; NTIS; INIS; GPO Dep.

We review the closed time path formalism of Schwinger using a path integral approach. We apply this formalism to the study of pair production from strong external fields as well as the time evolution of a nonequilibrium chiral phase transition. In 1961 in his classic paper "Brownian Motion of a Quantum Particle," Schwinger solved the formidable technical problem of how to use the action principle to study initial value problems. Previously, the action principle was formulated to study only transition matrix elements from an earlier time to a later time. The elegant solution of this problem was the invention of the closed time path (CTP) formalism. This formalism was first used to study field theory problems by Mahanthappa and Bakshi. With the advent of supercomputers, it has now become possible to use this formalism to numerically solve important field theory questions which are presented as initial value problems. Two of these problems we shall review here. They are (1) The time evolution of the quark- gluon plasma. (2) Dynamical evolution of a non-equilibrium chiral phase transition following a relativistic heavy ion collision.

22555 (LBL--36819) **Broken flavor symmetries in high energy particle phenomenology.** Antaramian, A. Lawrence Berkeley Lab., CA (United States). 22 Feb 1995. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (UCB-PTH-95/05). Order Number DE95012353. Source: OSTI; NTIS; INIS; GPO Dep.

Over the past couple of decades, the Standard Model of high energy particle physics has clearly established itself as an invaluable tool in the analysis of high energy particle phenomenon. However, from a field theorists point of view, there are many dissatisfying aspects to the model. One of these, is the large number of free parameters in the theory arising from the Yukawa couplings of the Higgs doublet. In this thesis, we examine various issues relating to the Yukawa coupeng structure of high energy particle field theories. We begin by examining extensions to the Standard Model of particle physics which contain additional scalar fields. By appealing to the flavor structure observed in the fermion mass and Kobayashi-Maskawa matrices, we propose a reasonable phenomenological parameterization of the new Yukawa couplings based on the concept of approximate flavor symmetries. It is shown that such a parameterization eliminates the need for discrete symmetries which limit the allowed couplings of the new scalars. New scalar particles which can mediate exotic flavor changing reactions

can have masses as low as the weak scale. Next, we turn to the issue of neutrino mass matrices, where we examine a particular texture which leads to matter independent neutrino oscillation results for solar neutrinos. We, then, examine the basis for extremely strict limits placed on flavor changing interactions which also break lepton- and/or baryon-number. These limits are derived from cosmological considerations. Finally, we embark on an extended analysis of proton decay in supersymmetric SO(10) grand unified theories. In such theories, the dominant decay diagrams involve the Yukawa couplings of a heavy triplet superfield. We argue that past calculations of proton decay which were based on the minimal supersymmetric SU(5) model require reexamination because the Yukawa couplings of that theory are known to be wrong.

22556 (LBL–36962) **Non-universal SUSY breaking, hierarchy and squark degeneracty.** Murayama, Hitoshi. Lawrence Berkeley Lab., CA (United States). 15 Mar 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-941251–5: 4. international conference on physics beyond the standard model, Lake Tahoe, CA (United States), 13-18 Dec 1994). Order Number DE95012377. Source: OSTI; NTIS; INIS; GPO Dep.

I discuss non-trivial effects in the soft SUSY breaking terms which appear when one integrates out heavy fields. The effects exist only when the SUSY breaking terms are non-universal. They may spoil (1) the hierarchy between the weak and high-energy scales, or (2) degeneracy among the squark masses even in the presense of a horizontal symmetry. I argue, in the end, that such new effects may be useful in probing physics at high-energy scales from TeV-scale experiments.

22557 (LBL–37016) **Low energy supersymmetry phenomenology.** Baer, H. (Florida State Univ., Tallahassee, FL (United States). Dept. of Physics); Chen, C.H.; Bartl, A. Lawrence Berkeley Lab., CA (United States); Florida State Univ., Tallahassee, FL (United States). Dept. of Physics; Hawaii Univ., Honolulu, HI (United States). Mar 1995. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ; FG05-87ER40319 ; FG03-94ER40833. Order Number DE95012331. Source: OSTI; NTIS; INIS; GPO Dep.

The authors summarize the current status and future prospects for low energy (weak scale) supersymmetry. In particular, they evaluate the capabilities of various e^+e^-, $p\bar{p}$ and pp colliders to discover evidence for supersymmetric particles. Furthermore, assuming supersymmetry is discovered, they discuss capabilities of future facilities to disentangle the anticipated spectrum of superparticles, and, via precision measurements, to test mass and coupling parameters for comparison with various theoretical expectations. They comment upon the complementarity of proposed hadron and e^+e^- machines for a comprehensive study of low energy supersymmetry.

22558 (SSCL-Preprint–21) **Vacuum orientations in strong CP violation.** Huang, Zheng (Simon Fraser Univ., Burnaby, BC (Canada). Dept. of Physics); Viswanathan, K.S.; Wu, Dan-di. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011257. Source: OSTI; NTIS; INIS; GPO Dep.

We study the QCD vacuum orientation angles in correlation with the strong CP phases. A vacuum alignment equation of the dynamical chiral symmetry breaking is derived based on the anomalous Ward identity. It is emphasized that a chiral rotation of the quark field causes a change of the vacuum orientation and a change in the definition of the light pseudoscalar generators. As an illustration of the idea, $\eta \to 2\pi$ decays are carefully studied in different chiral frames and shown to be independent of. chiral rotations.

22559 (SSCL-Preprint–506-93) **Low energy gauge couplings in grand unified theories and high precision physics.** Lynn, B.W. (Stanford Univ., CA (United States). Dept. of Physics). Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 21p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Texas National Research Lab. Commission, De Soto, TX (United States). DOE Contract AC35-89ER40486. NSF-PHY-89-17438. (SU-ITP–93-22). Order Number DE95011205. Source: OSTI; NTIS; INIS; GPO Dep.

I generalize the leading log relations between low energy $SU(3)_{QCD}$, $SU(2)_{-}$ and $U(I)_Y$ effective gauge couplings to include all one-loop threshold effects of matter fields in oblique vector self energy quantum corrections for both supersymmetric and non-supersymmetric SU(5) grand unified theories. These always involve an exactly conserved current from the unbroken $SU(3)_{QCD} \times U(L)_{QED}$ subgroup; this fact strongly constrains any non-decoupling of heavy states as well as the generic character of threshold effects. Relations between low energy gauge couplings depend on the details of the spectra of both the superheavy and low mass sectors; I display the common origin of the logs appropriate to superheavy matter states, which can be found with well known renormalization group techniques, and the combination of logs and polynomials appropriate for light matter states, which cannot. Relations between any two or all three low energy effective gauge couplings do not depend on the top quark or standard model Higgs' masses. Neither do they depend on neutral color singlet states such as other neutral color singlet Higgs' or higgsinos, neutrinos, zinos or photinos. Further, they do not depend on degenerate SU(5) matter representations, of either spin 0 or spin 1/2 of any mass; matter representations of SU(5) can affect such relations only if there is mass splitting within them. The b quark splitting from the τ and ν_τ can affect the relation between gauge couplings for $|q_2| \to m_b{}^2$ as can hadronic resonances and multi-hadron states for lower $|q_2|$. New mass-split representations of light states, such as occur in supersymmetric theories, can also affect such relations.

22560 (SSCL-Preprint–526) **High p_t physics processes.** Bird, F.; Blocker, C.; Fukui, T.; McBride, P.; Paige, F.; Pal, T.; Takashima, M.; Turcotte, M.; Siegrist, J. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011139. Source: OSTI; NTIS; INIS; GPO Dep.

In order to estimate the "physics reach" of various pp or $\bar{p}p$ colliders, several physics processes of interest have been studied. For each process, the number of produced events required to carry out meaningful.physics studies or detect statistically significant signals has been estimated. These estimates are largely based on detailed studies for the SDC and GEM design reports. Extrapolation to other energies takes into account calculated cross sections and crude background estimates. To convert the required number of events into an average luminosity to be delivered by the machine, a "running year" of 10^7 seconds is used. This time is consistent with SSC design plans, which call for an 80% detector up time and enough stable beam time to result in 10^7 "live" seconds per operating year. Note that when making comparisons with existing facilities, any deviation from these assumptions should be taken into account. The conclusions of this study are generally sim-ilar to those reached by Eichten, et al. in 1984 and by the Drell Panel in 1990.

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 22554, 22555, 22558, 22560, 22619, 22630, 22635, 22662, 22669, 22766, 22767, 22768

22561 (BNL–61748) **Electro symmetry breaking and beyond the standard model.** Barklow, T. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Dawson, S.; Haber, H.E.; Siegrist, J. Brookhaven National Lab., Upton, NY (United States). May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012316. Source: OSTI; NTIS; INIS; GPO Dep.

The development of the Standard Model of particle physics is a remarkable success story. Its many facets have been tested at present day accelerators; no significant unambiguous deviations have yet been found. In some cases, the model has been verified at an accuracy of better than one part in a thousand. This state of affairs presents our field with a challenge. Where do we go from here? What is our vision for future developments in particle

physics? Are particle physicists' recent successes a signal of the field's impending demise, or do real long-term prospects exist for further progress? We assert that the long-term health and intellectual vitality of particle physics depends crucially on the development of a new generation of particle colliders that push the energy frontier by an order of magnitude beyond present capabilities. In this report, we address the scientific issues underlying this assertion.

22562 (BNL–61794) **To VMD, or not to VMD, in the quark-gluon plasma.** Pisarski, R.D. Brookhaven National Lab., Upton, NY (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9502102–1: International workshop on chiral dynamics in hadrons and nuclei, Seoul (Korea, Republic of), 6-10 Feb 1995). Order Number DE95013321. Source: OSTI; NTIS; INIS; GPO Dep.

I review results on the shift of the ρ meson mass at nonzero temperature in a gauged linear sigma model, under the assumption of strict vector meson dominance.

22563 (DOE/ER/40561–176) **QCD and hadron structure.** Kaplan, D.B. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561. (CONF-9507126–1: Nuclear theory town meeting, Argonne, IL (United States), 20-30 Jul 1995). Order Number DE95012173. Source: OSTI; NTIS; INIS; GPO Dep.

I give a brief and selective overview of QCD as it pertains to determining hadron structure, and the relevant directions in this field for nuclear theory. This document is intended to start discussion about priorities, not end it.

22564 (DOE/ER/40757–059) **Top quark signatures in extended color theories.** Dicus, D.A. (Texas Univ., Austin, TX (United States). Center for Particle Physics); Dutta, B.; Nandi, S. Texas Univ., Austin, TX (United States). Center for Particle Physics. 6 Dec 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93ER40757 ; FG02-94ER40852. Order Number DE95007099. Source: OSTI; NTIS; INIS; GPO Dep.

We consider the implications of an extended color group, SU $(3)_I$ x SU $(3)_{II}$, spontaneously broken to SU $(3)_c$ at a TeV or lower scale, for the hadronic colliders. The associated massive color octet gauge bosons (the colorons) can enhance the $t\bar{t}$ pair production at the Tevatron collider. At the LHC, the colorons can be pair produced, each decaying to a $t\bar{t}$ pair. This gives rise to anomalous multi W production.

22565 (FNAL/C–95/094) **QCD at D0 and CDF.** Blazey, G.C. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503147–2: Rencontres de Physique de la Valle' d'Aoste, La Thuile (Italy), Mar 1995). Order Number DE95013003. Source: OSTI; NTIS; INIS; GPO Dep.

Selected recent Quantum Chromodynamics (QCD) results from the D0 and CDF experiments at the Fermilab Tevatron are presented and discussed. The inclusive jet and inclusive triple differential dijet cross sections are compared to next-to-leading order QCD calculations. The sensitivity of the dijet cross section to parton distribution functions (for hadron momentum fractions $\sim$ 0.01 to $\sim$ 0.4) will constrain the gluon distribution of the proton. Two analyses of dijet production at large rapidity separation are presented. The first analysis tests the contributions of higher order processes to dijet production and can be considered a test of BFKL or GLAP parton evolution. The second analysis yields a strong rapidity gap signal consistent with colorless exchange between the scattered partons. The prompt photon inclusive cross section is consistent with next-to-leading order QCD only at the highest transverse momenta. The discrepancy at lower momenta may be indicative of higher order processes impacting a transverse momentum or "k_T" to the partonic interaction. The first measurement of the strong coupling constant from the Tevatron is also presented. The coupling constant can be determined from the ratio of W + 1jet to W + 0jet cross sections and a next-to-leading order QCD calculation.

22566 (IC–95/45) **SU($2N_f$) x 0(3) light diquark symmetry and current-induced heavy baryon transition form factors.** Hussain, F. (International Centre for Theoretical Physics, Trieste (Italy)); Koerner, J.G.; Landgraf, J.; Tawfiq, S. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 19p. (MZ-TH–95-15; Hep-ph–9505335.). Order Number DE95633969. Source: OSTI; NTIS (US Sales Only); INIS.

We study the current-induced bottom baryon to charm baryon transitions in the Heavy Quark Symmetry limit as $m_q \to \infty$. Our discussion involves s-wave to s-wave as well as s-wave to p-wave transitions. Using a constituent quark model picture for the light diquark system with an underlying SU($2N_f$) x 0(3) symmetry and the heavy quark symmetry we arrive at a number of new predictions for the reduced form factors that describe these transitions. (author). 17 refs, 2 tabs.

22567 (IC–95/76) **Models of light singlet fermion and neutrino phenomenology.** Chun, E.J.; Joshipura, A.S.; Smirnov, A.Yu. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 12p. (PRL-TH–95-7; Hep-ph–9505275.). Order Number DE95633955. Source: OSTI; NTIS (US Sales Only); INIS.

We suggest that a single fermion S exists beyond the standard see-saw structure. It mixes with light neutrinos via interactions with the right-handed neutrino components, so that $\nu_e \to$ S conversion solves the solar neutrino problem. Supersymmetry endowed with R-symmetry is shown to give a natural framework for existence, mass scale ($\approx 3 \cdot 10^{-3}$ eV) and mixing ($\sin^2 2\theta_{es} \approx (0.1 - 1.5) \cdot 10^{-2}$) of such a fermion. Models with an approximate horizontal symmetry are constructed, which embed the fermion S and explain simultaneously solar, atmospheric, hot dark matter problems as well as may predict the oscillation ν-bar$_\mu \to \nu$-bar$_e$ in the region of sensitivity of KARMEN and LSND experiments. (author). 24 refs.

22568 (IC–95/80) **Predictions of the top mass in minimal supersymmetric left-right model.** Brahmachari, B. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 9p. Order Number DE95633970. Source: OSTI; NTIS (US Sales Only); INIS.

The one-loop evolution of Yukawa couplings in the minimal supersymmetric left-right model (MSUSYLR) model with a wide variation of the right-handed breaking scale M_R from 1 TeV to 10^{18} GeV is studied assuming that all third generation Yukawa couplings are equal and in the fixed point domain of the top quark Yukawa coupling (h_t) at the Plank scale. We show that: (1) The top quark Yukawa coupling h_t displays a fixed point behaviour that is similar to that of the minimal supersymmetric standard model (MSSM). (2) The MSUSYLR model predicts a value of the top mass in the interval 177 to 184 GeV for α_s in the interval 0.11 to 0.12 (3). A large value of tanβ is required to reproduce the correct mass of the bottom quark and tau lepton. (4) With the experimental value of the ratio $m_b(m_b)/m_\tau(m_\tau)$ as an input the range of the right-handed symmetry breaking scale M_R can be predicted. (5) The numerical value of the Majorana Yukawa coupling h_M can be calculated which is otherwise a completely free parameter. (author). 16 refs, 4 tabs.

22569 (INIS-RU–405, pp. 363-366) **On possibility of observation of anomalous magnetic moment of electrons (positrons) in crystals.** Baryshevskij, V.G.; Shekhtman, A.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Anomalous magnetic moment of electrons (positrons) in crystals has been measured. The described measurements of depolarization permit to check up the fundamental effect of anomalous magnetic moment change in external fields.

22570 (JINR-E–2-94-488) **To the Problem of $1/N_c$ Approximation in the Nambu-Jona-Lasinio Model.** Ebert, D. (Humboldt-Universitaet, Berlin (Germany). Inst. fuer Physik); Nagy, M.; Volkov, M.K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 10p. Order Number DE95632521. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Yadernaya Fizika.

The gap equation for the constituent quark mass in the U(2) x U(2) Nambu-Jona-Lasinio model for the $1/N_c$ approximation is investigated. It is shown that taking into account scalar isovector mesons plays an important role for the correct description of quark

masses in this approximation. The role of the Ward identity in calculations of $1/N_c$ corrections to the meson vertex functions is shortly discussed. 13 refs., 3 figs., 1 tab.

22571 (JINR-E–4-94-123, pp. 30) **Flavour, spin and electromagnetic aspects of the meson cloud in the nucleon.** Szczurek, A. (Institute of Nuclear Physics, Cracow (Poland)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs. NUCLEONS/mesons; FLAVOR MODEL; FORM FACTORS; NUCLEONS; MESONS; PARTICLE RADII; QUARKS; SPIN

22572 (JINR-E–4-94-123, pp. 36) **Pion-nucleon interactions in an effective chiral QCD.** Musakhanov, M.M. (Tashkentskij Gosudarstvennyj Univ., Tashkent (Uzbekistan)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 refs. PION-NUCLEON INTERACTIONS/ scattering amplitudes; SU-2 GROUPS

22573 (JINR-E–4-94-123, pp. 125) **The NJL model with the homogeneous self-dual background gluon field.** Burdanov, Ja.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Efimov, G.V.; Nedelko, S.N.; Solunin, S.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PARTICLE MODELS; DUALITY; GLUONS; MASS; MESONS; QUARKS

22574 (JINR-R–2-94-150, pp. 33-38) **Gauge forces in the gravity theory.** Pestov, A.B. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

Existence is predicted of a new force with purely quantum nature and unknown particles which can explain existence of dark matter because the new particles have no string, weak or electromagnetic interactions with the known particles. 7 refs.

22575 (JINR-R–2-94-150, pp. 54-59) **Tetrad formulation of the Brinkman conditions.** Bagrov, V.G. (Tomskij Gosudarstvennyj Univ., Tomsk (Russian Federation)); Obukhov, V.V.; Osetrin, K.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

Compatibility conditions are obtained for conformally-transformed Einstein vacuum equations with Λ-term in a compact and suitable form both in metric formalism and in the Newman-Penrose tetrad formalism. 3 refs.

22576 (JINR-R–2-94-150, pp. 121-126) **On the inertial anomalies in an electric and magnetic field distribution in a dielectric medium evolutionating in the field of gravitational radiation.** Balakin, A.B. (Kazanskij Univ, Kazan (Russian Federation)); Vakhrushev, D.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). In *Gravitational energy and gravitational waves.* Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

On the base of investigating hierarchic systems (HS) in the field of gravitational radiation (GR) the next hypothesis is proposed: on the availability of the GR field appear nonequilibrium phenomena in which is preserved information on the direction and value of the macroscopic velocity of HS motion in a whole. 6 refs.

22577 (SSCL-Preprint–13) **An effective field theory calculation of the QCD corrections to weak parameters.** Grinstein, B. (Superconducting Super Collider Lab., Dallas, TX (United States)); Wang, Meng-Yuan. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1991. 29p. Sponsored by USDOE, Washington, DC (United States);Texas National Research Lab. Commission, De Soto, TX (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC35-89ER40486. G phy-87-14654; G rgfy9106. (HUTP–90/A029). Order Number DE95011255. Source: OSTI; NTIS; INIS; GPO Dep.

In the standard model the parameters ρ and $M_W^2/M_Z^2\cos^2\theta$ are unity at tree level. They are protected against large corrections by the so-called custodial symmetry. We investigate the symmetry breaking effect of effect of mass splittings in fermion doublets. The effective field theory method is applied to sum up the leading-log QCD corrections. We resolve a controversy concerning the scale at which the strong coupling constant is to be evaluated in the two-loop correction to electorweak parameters.

22578 (SSCL-Preprint–534) **The magnitude of the gluon condensate and the masses of c and b quarks from the families of T/Ψ and Υ mesons.** Geshkenbein, B. (Inst. of Theoretical and Experimental Physics, Moscow, (Russian Federation)); Morgunov, V. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011028. Source: OSTI; NTIS; INIS; GPO Dep.

It is shown that the model used by Shifman, Vainshtein, and Zakharov for the description of the experimental function $R_c(s)$ in the form of a sum of δ-functions and the plateau contradicts the Wilson operator expansion (O.E.) in the terms due to the gluon condensate. A QCD model with an infinite number of vector mesons does satisfy the requirements of the O.E. for masses and electronic width resonances close to the experimental values. The region of allowable values of the masses of c- and b-quarks and the gluon condensate compatible with the O.E. is obtained.

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 21885, 21912, 22521, 22560, 22659, 22695, 22754

22579 (BNL–61775) **Overview of rare K decays.** Littenberg, L. Brookhaven National Lab., Upton, NY (United States). [1995]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9410285–3: 2. international workshop on heavy quark physics in fixed targets, Charlottesville, VA (United States), 6-10 Oct 1994). Order Number DE95012081. Source: OSTI; NTIS; INIS; GPO Dep.

The status and future prospects of searches for and studies of forbidden and highly suppressed K decays are reviewed. Here the author discusses three areas of recent activity in rare K decay. These are lepton-flavor violating decays, which are entirely forbidden in the Standard Model, $K_S \rightarrow \pi^+\pi^-\pi^0$, which is of interest from the point of view of CP-violation, and 'one loop' decays of the form $K^{0,\pm} \rightarrow (\pi^{0,\pm})\ell\bar{\ell}$, that can throw light on Standard Model CP-violation and determine parameters such as V_{td}.

22580 (DOE/ER/40399–5) **Study of neutron-proton interaction in the 300–700 MeV energy region. Final progress report, July 1991–August 1994.** Northcliffe, L.C.; Hiebert, J.C. Texas A and M Univ., College Station, TX (United States). Cyclotron Inst. Aug 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER40399. Order Number DE95012427. Source: OSTI; NTIS; INIS; GPO Dep.

The experimental program supported by the present grant is a continuation of the work supported under DOE Contract DE-AS05-76ER04449. More detailed discussion of the experimental apparatus and earlier activities can be found in annual reports for that contract and this grant. The primary objective of this program is investigation of the nucleon-nucleon (NN) interaction, in the medium-energy region, in both elastic and inelastic channels.

22581 (FNAL/C–95-060-E) **Kinematic top analyses at CDF.** Grassmann, H. CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503147–1: Rencontres de Physique de la Valle' d'Aoste, La Thuile (Italy), Mar 1995). Order Number DE95011499. Source: OSTI; NTIS; INIS; GPO Dep.

We present an update of the top quark analysis using kinematic techniques in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV with the Collider Detector at Fermilab (CDF). We reported before on a study which used 19.3 pb^{-1} of data from the 1992–1993 collider run, but now we use a larger data sample of 67 pb^{-1}. First, we analyze the total transverse energy of the hard collision in W+$\geq$3 jet events, showing the likely presence of a $t\bar{t}$ component in the event sample. Next, we compare in more detail the kinematic structure of W+ $\geq$3 jet events with expectations for top pair production and with background processes, predominantly direct W+ jet production. We again find W+ $\geq$ 3 jet events which cannot be explained in terms of background, but show kinematic features as expected from top. These events also show evidence for beauty quarks, in agreement with expectations from top, but not compatible with expectations from backgrounds. The findings confirm the observation of top events made earlier in the data of the 1992–1993 collider run.

22582 (FNAL/C–95/062-E) **CDF results on $Z\gamma$ production.** Wagner, R.G. (Argonne National Lab., IL (United States)). CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (ANL-HEP-CP–95-20; CONF-950287–3: International symposium on vector boson interactions, Los Angeles, CA (United States), 1-3 Feb 1995). Order Number DE95011500. Source: OSTI; NTIS; INIS; GPO Dep.

Results on Z_γ production observed by the Collider Detector at Fermilab (CDF) from the Tevatron Collider Run Ib and preliminary results from 36pb^{-1} of integrated luminosity from Run Ib. Both the Run Ia and Ib results are consistent with expectations from the Standard Model.

22583 (FNAL/C–95/095-E) **D0 search for new phenomena.** Eno, S. (Univ. of Maryland, College Park, MD (United States). Dept. of Physics). Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–4: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013246. Source: OSTI; NTIS; INIS; GPO Dep.

D0 Collaboration.

Presented here are the results from three searches for non-standard model particles using approximately 13 pb^{-1} of data taken with the D0 detector at Fermilab's Tevatron, a $p\bar{p}$ collider operating at center-of-mass energy $\sqrt{s}$=1.8 TeV. A heavy right-handed W, predicted by left-right symmetric theories, is excluded at 95% confidence level with mass between 200 GeV/c^2 and 540 GeV/c^2, for a right-handed neutrino mass less than 100 GeV/c^2, regardless of the decay-properties of the neutrino, and assuming the W_R's couplings and C-K-M matrix are the same as the standard model W. Stricter limits are given on the right-handed neutrino mass for W_R masses near the upper limit, and for specific assumptions on the right-handed neutrino decay modes. A 95% confidence-level limit on the cross-section $p\bar{p} \rightarrow W_1Z_2 \rightarrow 3$ leptons, where $_1$, is the lightest supersymmetric partner of the charged vector bosom and charged higgs and Z_2 is the second lightest supersymmetric partner of the Z, γ, and neutral higgs, ranging from 3 pb for M_{W1}, =45 GeV/c^2 to 1 pb for M_{W1}=100 GeV/c^2 is presented, assuming mass relations between the supersymmetric particles predicted by a popular supergravity inspired model. Third, a 95% confidence-level limit on the mass of the supersymmetric partner of the gluon of 144 GeV/c^2, if the supersymmetric partner of the quarks are very heavy, or 212 GeV/c^2, if they have equal masses, is presented within the framework of the same popular model.

22584 (FNAL/C–95/102-E) **Observation of the top quark.** Klima, B. D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–2: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013000. Source: OSTI; NTIS; GPO Dep.

The D0 collaboration reports on a search for the Standard Model top quark in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV at the Fermilab Tevatron, with an integrated luminosity of approximately 50 pb^{-1}. We have searched for $t\bar{t}$ production in the dilepton and single lepton decay channels, with and without tagging of b quark jets. We observe 17 events with an expected background of 3.8 $\pm$ 0.6 events. The probability for an upward fluctuation of the background to produce the observed signal is 2 $\times$ 10^{-6} (equivalent to 4.6 standard deviations). The kinematic properties of the excess events are consistent with top quark decay. We conclude that we have observed the top quark and measure its mass to be 199_{-21}^{+19} (stat.) $\pm$22 (syst.) GeV/c^2 and its production cross section to be 6.4 $\pm$ 2.2 pb.

22585 (FNAL/C–95/106-E) **Observation of the top quark.** Thompson, J. (Maryland Univ., College Park, MD (United States)). D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–5: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013584. Source: OSTI; NTIS; INIS; GPO Dep.

The D0 collaboration reports on a search for the Standard Model top quark in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV at the Femilab Tevatron, with an integrated luminosity of approximately 50 pb^{-1}. We have searched for $t\bar{t}$ production in the dilepton and single-lepton decay channels, with and without tagging of b quark jets. We observe 17 events with an expected background of 3.8 $\pm$ 0.6 events. The probability for an upward fluctuation of the background to produce the observed signal is 2 δ 10^{-6} (equivalent to 4.6 standard deviations). The kinematic properties of the excess events are consistent with top quark decay. We conclude that we have observed the top quark and measure its mass to be 199_{-21}^{+19} (stat.) $\pm$22 (syst.) GeV/c^2 and its production cross section to be 6.4 $\pm$ 2.2 pb.

22586 (FNAL/C–95/133-E) **Charm production physics from Fermilab fixed-target experiments.** Gardner, R. (Illinois Univ., Urbana, IL (United States). Dept. of Physics). Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–6: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013585. Source: OSTI; NTIS; INIS; GPO Dep.

Recent analyses of charm quark production mechanisms from Fermilab fixed-target experiments are summarized. Measurements of single inclusive differential cross sections for hadroproduced and photoproduced D mesons are compared to next-to-leading order QCD calculations. New data from hadroproduction and previous photoproduction measurements of charm meson pair correlations are compared to NLO calculations and also to parton shower Monte Carlo models. Nonperturbative effects, such as intrinsic k_t and fragmentation, are seen to play an important role in most of these comparisons. Results on charm production asymmetries in both hadroproduction and photoproduction are summarized.

22587 (FNAL/C–95/137-E) **Measurements of heavy quark production at D0.** Markosky, L. (Arizona Univ., Tucson, AZ (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–8: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013588. Source: OSTI; NTIS; INIS; GPO Dep.

We report measurements of the inclusive single muon and b-quark cross sections in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV using the D0

detector at the Fermilab collider, for the kinematic range $|yb| < 1.0$ and $P_t^b > 6$ GeV/c. We also report preliminary measurements on the J/ψ and Υ production cross sections.

22588 (FNAL/C–95116-E) **Jet shapes at D0 and CDF.** Streets, K.T. (New York Univ., NY (United States)). D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–1: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95012973. Source: OSTI; NTIS; INIS; GPO Dep.

The distribution of the transverse energy in jets has been measured in $p\bar{p}$ collisions at $\sqrt{s} = 1.8$ TeV at the Fermilab Tevatron collider using the CDF and DO detectors. This measurement of the jet shape is made as a function of jet transverse energy in both experiments and as a function of the jet pseudorapidity in the D0 experiment. Comparisons to Monte Carlo simulations and next-to-leading order partonic QCD calculations, $O(\alpha_s^3)$, are presented.

22589 (IC–95/50) **On the form factors of the $D^+_s \to \phi\ \mu^+\ \upsilon_\mu$ decay.** Hussain, F.; Ivanov, A.N.; Troitskaya, N.I. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 7p. (Hepph–9505273.). Order Number DE95633989. Source: OSTI; NTIS (US Sales Only); INIS.

We apply the infinite mass effective theory, when a heavy quark mass tends to infinity, and Chiral perturbation theory at the quark level, based on the extended Nambu - Jona - Lasinio model with linear realization of chiral U(3) x U(3) symmetry, to calculate the form factors of the $D^+_s \to \phi\ \mu^+\ \upsilon_\mu$ decay up to the first order in current s - quark mass. The theoretical results are compared with experimental data and found to be in good agreement. (author). 12 refs.

22590 (INIS-RU–405) **IV. Workshop on High Energy Spin Physics.** Nurushev, S. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian, English). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

In this proceedings the results on high energy spin physics are summarized. The theory of spin phenomenon and the experimental results at intermediate energy and at high energy spin physics and new technical developments in polarization experiments are presented.

22591 (INIS-RU–405, pp. 5-55) **Polarization experiments (review).** Nurushev, S.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The achievements both in theoretical physics and experimental techniques on polarization studies in a wide energy range have been reviewed. A programme on polarization studies for largest now available machines and those under construction is proposed. 20 refs.

22592 (INIS-RU–405, pp. 121-124) **Single spin asymmetry in inclusive meson production: What can learn from the high-energy large-X_F data?.** Ta-chung, M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Single-spin asymmetry in high-energy inclusive pion production processes using polarized proton and antiproton beams is discussed. Significant effects have been observed in the projectile fragmentation region. 6 refs.

22593 (INIS-RU–405, pp. 132-139) **Measuring the gluon polarization from Drell-Yan reactions at large transverse momentum.** Sridhar, K.; Leader, E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The production of dimuon pairs at large transverse momentum via proton-proton collisions experiments where either the beam or the target is polarized is considered. 12 refs.

22594 (INIS-RU–405, pp. 140-144) **Quark-sea contribution to spin effects at high energies.** Goloskokov, S.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this report is the investigation of some non perturbation contributions to the spin-flip processes at high energies. However the simple rescattering on the spin-flip pomerons cannot explain the spin effects in large-angle scattering. 8 refs.

22595 (INIS-RU–405, pp. 148-163) **Structure functions of sea quarks, Kogut-Susskind pole and dynamics of pp- and pp-interactions at high energies.** Dorokhov, A.E. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that anomalous behaviour of the spin-dependent proton structure function is defined by the contribution to this structure function of a new Regge trajectory caused by Kogut-Susskid pole. 38 refs.; 5 figs.

22596 (INIS-RU–405, pp. 164-168) **Supercritical pomerons and spin in pp-scattering.** Martynov, E.S. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Spin amplitudes in elastic spin amplitudes in elastic pp(pp) scattering without crossing-odd contribution are considered. The account of multipomeron exchangers is performed. The spin properties of the pomerons are clarified. 11 refs.

22597 (INIS-RU–405, pp. 169-174) **Single-spin asymmetry in π+0 production by polarized antiprotons and protons.** Jenkovskij, L.L. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Some implications of the spectacular results, collected recently on single-spin asymmetry in inclusive π+0 production by 200 GeV polarized protons and antiprotons at Fermilab. Specifically the observed oscillations in single-spin asymmetry are considered. 7 refs.

22598 (INIS-RU–405, pp. 175-190) **Spin effects in the elastic scattering of nucleons and new approach to problems of spin structure of hadrons.** Babbaev, Z.R.; Shchelkachev, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The work is dedicated to the perspective of describing the polarization effects in the framework of quark-quark model with the use odd density matrix in the description of parton spin states in hadrons. 12 refs.

22599 (INIS-RU–405, pp. 191-205) **Lowest-order processes in polarized e^+e^-, $e\gamma$, $\gamma\gamma$ collisions with W,Z production.** Ivkin, A.V.; Kushnirenko, E.A.; Kuraev, E.A.; Nazirov, M.T. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of Standard Model the Born's cross sections for various 2->2 processes of W,Z-production as a result of the polarized e^+e^-. $e\gamma$, $\gamma\gamma$ collisions have been calculated. The results are illustrated by graphs. For comparison basic QED cross-section for the same kinematics are presented.

22600 (INIS-RU–405, pp. 206-209) **Higher-twist subprocess contributions to dilepton production.** Agaev, Sh.S.; Sadychov, F.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Calculations of the higher-twist subprocess contributions to an inclusive dilepton production cross section in a hadron-meson collision are reported. 17 refs.

22601 (INIS-RU–405, pp. 210-213) **Higher-twist subprocess and helicity asymmetry A_{LL} for the reactions H_1H_2->lMX.** Agaev, Sh.S.; Sadychov, F.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The higher-twist contribution to double helicity asymmetry for an inclusive dilepton-meson hadroproduction; Meson contributions directly in the constituent scattering subprocesses are shown in this diagrams. 11 refs.

22602 (INIS-RU–405, pp. 221-231) **High-X_1 single-spin asymmetry in π^0 and η production at X_F=0 by 200-GeV polarized antiprotons and protons.** Adams, D.L. (and others); Akchrin, N.; Belikov, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The single-spin asymmetry A_N, the left-right asymmetry of the production cross sections in inclusive π^0 and η transversely polarized protons and antiprotons incident have been measured. The results for A_N in η production and π^0 production by antiprotons have been also presented. 17 refs.

22603 (INIS-RU–405, pp. 232-242) **Large-X_F spin asymmetry in π^0 production by 200-GeV polarized protons.** Adams, D.L. (and others); Akchurin, N.; Belikov, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The spin asymmetry A_N for inclusive π^0 production by 200-GeV protons on a liquid hydrogen target has been measured at Fermilab over a wide range. This result provides new input regarding the question of the internal spin structure of protons. 22 refs.

22604 (INIS-RU–405, pp. 243-251) **Comparison of spin asymmetries and cross sections in π^0 production by 200-GeV polarized antiprotons and protons.** Adams, D.L. (and others); Akcurin, N.; Belikov, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The single-spin asymmetry for inclusive π^0 production by 200-GeV transversely-polarized antiprotons on protons has been measured at Fermilab over a wide range of X_F. The ratio of the spin-averaged cross sections for π^0 production by antiprotons and by protons are also presented. 8 refs.

22605 (INIS-RU–405, pp. 252-258) **First results for the two-spin parameters A_{LL} in π^0 production by 200 GeV polarized protons and antiprotons.** Adams, D.L. (and others); Akchurin, N.; Belikov, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The two-spin parameter A_{LL} in inclusive π^0 production by longitudinally-polarized protons and antiprotons on a longitudinally-polarized proton target has been measured at the 200 GeV Fermilab. The data are in good agreement with conventional small or zero, gluon polarization. 6 refs.

22606 (INIS-RU–405, pp. 259-287) **Antinucleon-nucleon and nucleon-nucleon total cross sections and elastic scattering observables at all energies.** Lafrance, P.; Lehar, F.; Loiseau, B.; Winternitz, P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The energy dependence of total cross sections and angular distributions of elastic scattering observables in antinucleon-nucleon and nucleon-nucleon interactions are compared. 78 refs.

22607 (INIS-RU–405, pp. 307-310) **Analysing power measurements in elastic proton-proton scattering at 24 and future measurements at 400 GeV.** Phelps, R.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Recent measurements of the analyzing power, A, in proton-proton elastic scattering at 24 GeV/c out to P^2_1=7.1 $(GeV/c)^2$ at the AGS clearly show that A is nonzero and increasing at high P^2_1. 9 refs.

22608 (INIS-RU–405, pp. 317-320) **The measurement of the spin rotation parameters R and A in πp elastic scattering in the energy region (1-2) motivation and experiment states.** Abaev, V.V. (and others); Bekhterev, V.S.; Beloglazov, Yu.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Measurements of the spin rotation parameters R and A in πp elastic scattering in the energy region are motivated and experimental set up is described. 7 refs.

22609 (INIS-RU–405, pp. 321-328) **Spin effects in rho-meson production at intermediate energies.** Alekseev, I.G. (and others); Budkovsky, P.E.; Kanavets, V.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin*

Physics. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The first preliminary results on the asymmetry in the production of pion pairs on protons polarized transversely to the beam direction in the reaction at the momentum of 1.78 GeV/c are obtained. The seal of the spin effects is such that their successful study is possible using modern experimental techniques. 4 refs.

22610 (JINR–94-1, pp. 26-27) **Search for narrow dibaryon resonances in the proton-proton Bremsstrahlung reaction at the energy below the pion threshold.** Khrykin, A.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Lazarev, A.B.; Shilov, S.N.; Stolypin, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. DIBARYONS/proton-proton interactions; PROTON-PROTON INTERACTIONS/bremsstrahlung; DIBARYONS; HELIUM; HYDROGEN; LIQUIDS; BREMSSTRAHLUNG

22611 (JINR–94-1, pp. 40-41) **Measurement of spin observables in pp → p K⁺Y.** Falomkin, I.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Ivanov, V.V.; Lyashenko, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. PROTON-PROTON INTERACTIONS; STRANGE PARTICLES/particle production; KAONS PLUS; MULTIPLICITY; PROTONS; SPIN

22612 (JINR–94-1, pp. 54-55) **Determination of N N-scattering amplitudes in the energy region from 1.1 to 2.7 GeV and search for a structure around T_{kin} = 2.1 GeV.** Barabash, L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Janout, Z.; Kalinnikov, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. PROTON-NEUTRON INTERACTIONS/scattering amplitudes; ASYMMETRY; ELASTIC SCATTERING; GEV RANGE 01-10; QUASI-ELASTIC SCATTERING

22613 (JINR–94-1, pp. 56-57) **The experimental study of n p elastic scattering amplitudes at 16 MeV.** Borisov, N.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bunyatova, E.I.; Burinov, V.F. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. PROTON-PROTON INTERACTIONS/scattering amplitudes; ELASTIC SCATTERING; MEV RANGE 10-100; POLARIZED BEAMS; POLARIZED TARGETS; TOTAL CROSS SECTIONS

22614 (JINR–94-1, pp. 58-59) **Spin observables in neutron-proton elastic scattering.** Drevenak, R. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Finger, M.; Finger, M. Jr. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 3 figs. PROTON-NEUTRON INTERACTIONS/charge-exchange interactions; ELASTIC SCATTERING; MEV RANGE 100-1000; NEUTRON SPECTRA; NEUTRONS; POLARIZED BEAMS; POLARIZED TARGETS; SPIN ORIENTATION

22615 (JINR–94-1, pp. 66-67) **Measurement of beauty particle lifetimes and hadroproduction cross-section.** Malyukov, S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Minashvili, I.; Romanovskij, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. B MESONS/lifetime; D MESONS/lifetime; LIFETIME; CROSS SECTIONS; KAONS; PARTICLE DECAY; PARTICLE PRODUCTION; PIONS; TRANSVERSE MOMENTUM

22616 (JINR–94-1, pp. 72-73) **Study of radiative K-decays with Hyperon spectrometer.** Asmolov, A.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Budagov, Yu.A.; Chirikov-Zorin, I.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. KAONS NEUTRAL/particle decay; KAONS PLUS/particle decay; SHOWER COUNTERS/particle decay; SHOWER COUNTERS/particle identification; ELECTRONS; FLOWSHEETS; GEV RANGE 01-10; PAIR PRODUCTION; PIONS NEUTRAL; PIONS PLUS; POSITRONS

22617 (JINR–94-1, pp. 76-77) **Study of spin effects at 400 to 3000 GeV using an internal jet target at UNK.** Barabash, L.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bilenkaya, S.I.; Borisov, N.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. PROTON-PROTON INTERACTIONS; PROTONS/spin orientation; COLLIDING BEAMS; GEV RANGE 100-1000; PROTONS; TEV RANGE 01-10

22618 (JINR–94-1, pp. 78-79) **Study of asymmetry in inclusive reactions $\pi^- p \to \pi^{-+,0}$ X and $\pi^- p \to K_L$ X at 40 GeV/c and $pp \to \pi^0$ X at 70 GeV/c.** Borisov, N.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bunyatova, E.I.; Kazarinov, Yu.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. PION MINUS-PROTON INTERACTIONS/asymmetry; GEV RANGE 10-100; INCLUSIVE INTERACTIONS; KAONS NEUTRAL LONG-LIVED; ASYMMETRY; PIONS; PROTON-PROTON INTERACTIONS

22619 (JINR-E–2-94-438) **Relativistic Description of the Exclusive Rare Radiative Decays of B Mesons.** Faustov, R.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Galkin, V.O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 18p. Order Number DE95632544. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Zeitschrift fuer Physic. C, Particles and Fields.

The exclusive rare radiative B-decays are studied in the framework of the relativistic quark model based on the quasipotential approach in quantum field theory. The large recoil momentum of the final vector meson allows for the expansion of the decay form factor in inverse powers of the b-quark mass. This considerably simplifies the analysis of these decays. The $1/m_b$ expansion is carried out up to the second order. The form factor of $B \to K^*\gamma$ decay is found to be $F_1^{B\to K^*\gamma}(0)=0.32\pm0.03$ and it leads to $BR(B \to K^*\gamma)=(4.5 \pm 1.5) \times 10^{-5}$, which is in agreement with the recent CLEO data. The form factors of the decays $B \to \rho\gamma$, $B_s \to \phi\gamma$ and $B_s \to K^*\gamma$ are also considered. The relation between rare radiative and semileptonic B-decays into light vector mesons is discussed. 33 refs., 2 figs., 1 tab.

22620 (JINR-E–4-94-123, pp. 34) **Recent PNPI results on $\pi^{\pm}p$ elastic scattering and charge splitting of P_{33} amplitude.**

Kruglov, S.P. (Peterburgskij Inst. Yadernoj Fiziki, Gatchina (Russian Federation)); Abaev, V.V.; Bazhanov, N.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PION MINUS-PROTON INTERACTIONS/ scattering amplitudes; PION PLUS-PROTON INTERACTIONS/ scattering amplitudes; ELASTIC SCATTERING; MEV RANGE 100-1000

22621 (JINR-E–4-94-123, pp. 35) **πN scattering and symmetry properties of high-spin hadron interactions.** Kulish, Yu.V. (Natsional'nyj Nauchnyj Tsentr Khar'kovskij Inst. Fiziki i Tekhnologii, Khar'kov (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. PION-NUCLEON INTERACTIONS/ scattering amplitudes; DELTA-1232 BARYONS; SPIN; SYMMETRY

22622 (JINR-E–4-94-123, pp. 37) **Role of correlated two-pion-exchange in πN scattering.** Schuetz, C.; Durso, J.W.; Holinde, K.; Speth, J. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PION-NUCLEON INTERACTIONS/ exchange interactions; ELASTIC SCATTERING; PARTIAL WAVES; PHASE SHIFT; PIONS

22623 (JINR-E–4-94-123, pp. 38) **Spin observables in neutron-proton elastic scattering.** Ahmidouch, A. (Geneva Univ. (Switzerland). Dept. de Physique Nucleaire et Corpusculaire); Arnold, J.; Brandt, B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PROTON-NEUTRON INTERACTIONS/ elastic scattering; MEV RANGE 100-1000; POLARIZED BEAMS; POLARIZED TARGETS; PROTONS; SPIN ORIENTATION

22624 (JINR-E–4-94-123, pp. 46) **Model-independent analysis of The $\pi\pi$-phase shifts from the πN->$\pi\pi$N data.** Pocanic, D. (Virginia Univ., Charlottesville, VA (United States). Dept. of Physics); Frlez, E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PION-PION INTERACTIONS/phase shift; PION-NUCLEON INTERACTIONS; SCATTERING AMPLITUDES; SCATTERING LENGTHS

22625 (JINR-E–4-94-123, pp. 101) **Reaction e p $\rightarrow$ e pγ and proton polarizability.** Galynskii, M.V. (Inst. of Physics, Minsk (Belarus)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. ELECTRON-PROTON INTERACTIONS; PROTONS/spin orientation; CROSS SECTIONS; ELECTRONS; MEV RANGE 100-1000; PROTONS

22626 (JINR-E–4-94-123, pp. 104) **Low-energy theorem for photo- and electroproduction of pions and dispersion relations.** L'vov, A.I. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PIONS/electroproduction; PIONS/ photoproduction; DISPERSION RELATIONS; LOW-ENERGY THEOREM; PHOTON-NUCLEON INTERACTIONS; PIONS; ELECTROPRODUCTION; PHOTOPRODUCTION

22627 (JINR-E–4-94-123, pp. 107) **η production in pp and p A interaction near threshold.** Chiavassa, E. (Turin Univ. (Italy). Dipt. di Fisica Sperimentale); Dellacasa, G.; De Marco, N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. ETA MESONS/particle production; DEUTERIUM TARGET; PROTON REACTIONS; PROTON-PROTON INTERACTIONS

22628 (JINR-E–4-94-123, pp. 111) **The experiment on η production in the π^-p $\rightarrow$ ηn reaction in near-threshold region.** Lopatin, I.V. (Petersburg Nuclear Physics Inst., Gatchina (Russian Federation)); Abaev, V.V.; Bekrenev, V.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ETA MESONS/particle production; MEV RANGE 100-1000; NEUTRONS; PION MINUS-PROTON INTERACTIONS

22629 (JINR-E–4-94-123, pp. 113) **Coherent pion radiation from nucleon antinucleon annihilation.** Amado, R.D. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Cannata, F.; Dedonder, J.P.; Locher, M.P.; Bin Shao. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PIONS/coherent production; NUCLEON-ANTINUCLEON INTERACTIONS; PIONS

22630 (LBL–37014) **Summary talk: Gauge bosons self interactions.** Hinchliffe, I. Lawrence Berkeley Lab., CA (United States). 31 Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950287–4: International symposium on vector boson interactions, Los Angeles, CA (United States), 1-3 Feb 1995). Order Number DE95012380. Source: OSTI; NTIS; INIS; GPO Dep.

A review is given of the theoretical expectations of the self couplings of gauge bosons and of the present experimental information on the couplings. The possibilities for future measurements are also discussed.

22631 (SLAC–451, pp. 28-56) **Production of polarized τ pairs and tests of CP violation using polarized e$^\pm$ colliders near threshold.** Su Tsai, Yung (Stanford Univ., CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. DOE Contract AC03-76SF00515. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The authors considers the production of τ pairs by electron-positron colliding beams at the maximum cross section near the

threshold. At this energy τ pairs are produced mostly in the s-wave which implies that the spin of the τ pairs are almost always pointing in the beam direction independent of the production angle. When both electrons and positrons are longitudinally polarized in the same direction, for example 90%, one can obtain τ pairs with 99% polarization in the direction of the polarization vectors of the incident beams. Tests of CP violation and study of the structure of weak interactions using such polarized τ pairs are discussed.

22632 (SLAC–451, pp. 57-68) **1. Charmonium Summary and 2. Experimental Charm Summary.** Toki, W. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

Charmonium physics is uniquely possible in a tau charm factory. The expected increase in data samples is a factor 100-1000 over current experiments. The physics potential and opportunities are (1) In gluonium physics, search for a bound state of 2 or more gluons by careful spin parity analysis of states produced in radiative J/Ψ decays. (2) In Ψ' decays, there are many charmonium measurements which currently are either poorly measured or non-existent. These include the two and three photon width of the η_C and J/Ψ, the discovery of the η'_c, the measurement of the hadronic decays of the χ_c and the normalization of the $p\bar{p}$ decays of the charmonium states observed by E760. (3) Further progress in understanding the hadronic Ψ' decays require a large statistics sample to measure the pattern of hadronic decays. A careful comparison to the J/Ψ hadronic decays should clarify this puzzle. The ultra high rate of the J/Ψ decays permits the possibility of high statistics study of light quark mesons. It appears a tau charm factory could contribute many branching ratio measurements. Finally, the ultra high rates of the J/Ψ and Ψ' decays permits a careful study of the detector acceptances which will be necessary to make further progress in tau and charm physics.

22633 (SLAC–451, pp. 95-97) **Introductory remarks.** Panofsky, W.K.H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is an introduction to the Tau Charm Factory workshop. To establish a firm scientific basis for future Tau Charm Factory plans one has to address the following two questions: (1) To what extent can and will work at other machines cover work that a Tau Charm Factory could do? Conversely (2) What are the required minimum parameters of a Tau Charm Factory which can do unique physics five years hence and beyond? This workshop has been organized to generate some preliminary answers in response to these two questions. Thus this Workshop is neither simply a scientific Workshop on the one hand or a planning session for specific machines on the other; rather it is something in between. During the workshop, specific plans or proposals for a Tau Charm Factory will be presented, but no attempt will be made to arrive at a consensus in response to such plans.

22634 (SLAC–451, pp. 184-205) **Charm physics – The theory case for a new generation of experiments.** Bigi, I.I. (Univ. of Notre Dame, IN (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses charm decays, lifetimes, and branching ratios, in terms of what is known today, by theory and experiment, and what could be learned from a new facility. A Tau Charm Factory will allow the advantage of lower standard model backgrounds in looking at charm particle decays. Questions the author feels are open include lifetimes of B, Λ, and Ξ particles, their branching ratios in SL and NL decays, and rare decay modes. Also the possibility to study D^0-$\bar{D}^0$ oscillations, and studies of CP violation effects. The author argues the primary purpose of such a facility would allow study of QCD in novel environments under controlled laboratory conditions. One can study charm and lepton decays, charmonium spectroscopy, and light quark/gluonia spectroscopy. In addition the facility opens the possibility of finding new physics in any of these systems.

22635 (SLAC–451, pp. 206-232) **Using charm to probe new physics.** Hewett, J.L. (Stanford Linear Accelerator Center, CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses new physics results which can be derived from detailed studies in the area of charm decays. A number of different models can be tested with such results, including the standard model, extended Higgs sector models, models which propose additional Q=−1/3 quarks, supersymmetry, left-right symmetric models, techni-color/composite models, and family symmetries. Processes which can be studied to test such models include D^0-$\bar{D}^0$ mixing, rare decays of D particles, CP violations, and assymetries in Z decays. Standard model loop corrections tend to be small in charmed particle systems, so long distance effects can dominate, and thus charm systems provide a good place to look for new physics. Unconventional models give the largest contributions in systems not tested when looking at K and B particle systems.

22636 (SLAC–451, pp. 233-292) **Charmed baryons and spectroscopy at CLEO II.** Besson, D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses charmed baryon physics and spectroscopy which has been studied at CLEO II. Discussed are charmed baryon studies at CESR, including absolute decay rates for Λ_c, Ξ_c^+, and Ξ_c^0, inclusive rates for $\Lambda_c \rightarrow \Lambda + X$, studies of exchange in Λ and Ξ decays, studies of $c \rightarrow s$ transitions in baryons, and production in e^+e^- collisions. Also discussed are meson spectroscopy results, including precision splittings in the D and D^* system, and mass measurements in the excited D meson family. Also discussed are charmed baryon spectroscopy at CLEO II, including masses and widths of Σ_c and Λ_c states.

22637 (SLAC–451, pp. 293-334) **Charm meson decays at CESR.** Yamamoto, H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses a number of different topics. First is the question of where CESR will be in the year 2000, in terms of luminosity and its detector, and the impact of this on charm physics. Also what has been learned of semileptonic decays of D^0, D^+, D_s, and Cabbibo-favored/suppressed decays. Studies of hadronic decays, Cabbibo-favored/suppressed, rare decays, mixing, and CP invariance. What role can a Tau Charm Factory play in this type of physics, and what can it tell us beyond what we can reach at present.

22638 (SLAC–451, pp. 335-389) **Fermilab fixed target charm program.** Cumalat, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses two upcoming fixed target experiments at Fermilab, which will provide upwards to 1 million reconstructed events in the charmed systems. The projections for experiment E831, a photoproduction experiment scheduled for 1996 to 1997 time frame, and E781, involving a hadron beam, are discussed in

light of earlier fixed target experiments which have yielded charm particle results. These experiments are aimed at precision lifetime measurements for Λ_c^+, $\Xi_c^{+,0}$, and Ω_c^0, and study of semileptonic decays of baryons. They also aim to study D^0-$\bar{D}^0$ mixing and suppressed Cabbibo decays, to measure absolute branching ratios, and to study semileptonic decays of D mesons.

22639 (SLAC–451, pp. 492-504) **Charmonium physics in a Tau Charm Factory.** Gu, Yifan (Institute of High Energy Physics, Beijing (China)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The present status of the charmonium system is reviewed. Emphasis is placed on the following issues: the hadronic decay puzzle; search for the vector glueball; confirmation of the $\eta_c(2S)$ and hc1 states; the χ_c physics. The possibilities at a future Tau Charm Factory are discussed.

22640 (SLAC–451, pp. 535-553) **Charmonium and J/Ψ physics.** Toki, W. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

Scalar Glueball or non-$q\bar{q}$ particle searchers are most interesting, however it has been problematic. Clear cut spin-parity tests are difficult. Advances may come from unexpected discoveries. Much of Charmonium is either not measured or poorly measured. Many measurements would be complementary to E760 and LEAR. Hadronic J/Ψ and Ψ′ decays might contribute to a study of rescattering effects which is important for CP violation measurements. J/Ψ and Ψ′ decays for detector checks and cross checks of BR measurements will be invaluable for high precision measurements of BR's, angular distributions and charge conjugation tests.

22641 (SLAC–451, pp. 554-592) **Monte Carlo Study of a Tau-Charm Factory.** Fan, Xiaoling. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

Monte Carlo study of Tau-Charm Factory has been seriously done by τcF team working at CERN and Spain. In order to prepare a specific proposal for a Tau-Charm Factory construction in Beijing, a Monte Carlo group in IHEP was set up in May 1994 to study the physics goals of Tau-Charm Factory. In the authors' Monte Carlo simulation, a simple MC frame was constructed. We did not consider the detailed structure of detector, events are generated by MC generators, then the track parameters are smeared according to the detector performances which are completely based on the talk presented at the Third Workshop on the Tau-Charm Factory by Professor Jasper Kirkby.

22642 (SLAC–451, pp. 616-682) **Tau physics at LEP: Status and potential.** Harton, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses the performance of LEP in 1994 as far as tau production is concerned. He projects the lifetime performance of LEP for tau physics results. He then discusses what has been learned from studies of tau decays. Michel parameters, lifetimes and branching ratios to leptonic decays, and to final states with hadrons and kaons along with neutrinos and other particles. Strong coupling constants are also discussed.

22643 (SLAC–451, pp. 683-719) **The TAO of the τ with CLEO II.** Besson, D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author provides a review of tau physics results derived from CLEO. In a broad manner he touches on measurement of the tau mass and neutrino mass, as well as the lifetime. He discusses studies of leptonic decay of the tau, in terms of precision tests for the Standard Model, and tests of the Lorentz structure, V-A and weak current parameters.

22644 (SSCL-Preprint–160) **Trigger and DAQ issues in low-mass Higgs searches.** Wang, E.M.; Botlo, M.; Dorenbosch, J.; Walbran, S. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011103. Source: OSTI; NTIS; INIS; GPO Dep.

Results from ongoing trigger and DAQ studies at the Superconducting Super Collider Laboratory are presented. Specific Higgs decay modes are identified, calorimetric triggering algorithms are examined, and implications for data acquisition are discussed.

22645 (SSCL-Preprint–480) **Exploiting the single-lepton event structure in the search for the top quark.** Cobal, M. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy)); Leone, S.; Grassman, H. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011136. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss whether the event structure can be useful in searching for the top quark in the single-lepton channel at the Tevatron, where the main obstacle is a considerable background from QCD W+ multijet production. We restrict our discussion to the case of a Standard Model top quark of heavy mass, $M_{top} > 100$ GeV.

6624 Properties of Specific Particles and Resonances

Refer also to citation(s) 22088, 22105, 22560, 22568, 22578, 22581, 22582, 22583, 22584, 22585, 22586, 22587, 22593, 22633, 22634, 22635, 22636, 22637, 22638, 22639, 22642, 22643, 22645, 22693, 22765

22646 (BNL–61419) **The Brookhaven muon g-2 experiment.** Bunce, G. Brookhaven National Lab., Upton, NY (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9509101–1: 8. international symposium on polarized phenomena in nuclear physics (SPIN 94), Bloomington, IN (United States), 15-22 Sep 1995). Order Number DE95007676. Source: OSTI; NTIS; INIS; GPO Dep.

A new experiment is being mounted at BNL to measure the anomalous magnet moment of the muon to 3 parts in 10^7. In this talk I will describe the physics issues that this precision allows us to explore, the experimental method, and an interesting new device which we will use to inject muons into our muon storage ring. The device is a 1.45T non-ferrous superconducting magnet, where all fringe field is contained by a superconducting sheet.

22647 (DOE/ER/40561–188) **Wee partons in large nuclei: From virtual dream to hard reality.** Venugopalan, R. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561. (CONF-950127–7: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95012168. Source: OSTI; NTIS; INIS; GPO Dep.

We construct a weak coupling, many body theory to compute parton distributions in large nuclei for $x \ll A^{-1/3}$. The wee partons are highly coherent, non-Abelian Weizsaecker-Williams fields. Radiative corrections to the classical results axe discussed. The parton distributions for a single nucleus provide the initial conditions for the dynamical evolution of matter formed in ultrarelativistic nuclear collisions.

22648 (FNAL/C–95/049) **Excited charmed mesons.** Butler, J.N.; Shukla, S. Fermi National Accelerator Lab., Batavia, IL

(United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950285–3: LAFEX international school in high energy physics, Rio de Janeiro (Brazil), 20 Feb 1995). Order Number DE95013245. Source: OSTI; NTIS; INIS; GPO Dep.

The experimental status of excited charmed mesons is reviewed and is compared to theoretical expectations. Six states have been observed and their properties are consistent with those predicted for excited charmed states with orbital angular momentum equal to one.

22649 (INIS-RU–405, pp. 67-99) **Experimental study of gluon polarization at UNK. (Physical project of the first stage of POLEX programme).** Akimenko, S.A. (and others); Arestov, Yu.I.; Belikov, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The experiment carrying out at UNK on the measurement of two-spin asymmetry in production of hidden charm particles X (3555) and J/Ψ (3100) and direct γ-quanta is discussed. At the first stage of POLEX programme at UNK it is suggested to receive the information on gluon density function, depending on spin. 28 refs.; 15 figs.

22650 (INIS-RU–405, pp. 100-111) **Theoretical interpretation of polarized leptoproduction data.** Efremov, A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The role of quarks and gluon in polarized leptoproduction in connection with the famous EMC experimental result is examined. The role of the ghost contribution in the generalized Goldberger-Treiman relation is emphasized. 35 refs.

22651 (INIS-RU–405, pp. 112-120) **Orbiting quarks in polarized protons.** Ta-chung, M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The question of existing the orbiting constituents in polarized hadrons is discussed and answered in the affirmative. Theoretical arguments and experimental evidence which have led to this conclusion are summarized in talk. 15 refs.

22652 (INIS-RU–405, pp. 125-131) **Testing proton spin models with polarized beams.** Ramsey, G. (Loyola Univ., Chicago, IL (United States). Dept. of Physics). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Models for spin-weighted parton distributions in a proton have been constructed. The quark contributions in different processes have been distinguished by defining the valence and sea quark (antiquark spin weighted distributions separately). These are discussed with polarized beam experiments at energies typical of Fermilab, CERN and UNK. 13 refs.

22653 (INIS-RU–405, pp. 291-302) **Polarized beam in storage rings and high precision measurements of particle masses.** Shatunov, M.; Skrinsky, A.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

A series of particle mass measurements has been carrie out using the polarized beams of electron-positron colliders VEPP-2M and VEPP-4. Conclusion has been done that achieved accuracy provides a kind of the metrological standard allowing to improve the accuracy of the mass values and resonances. 22 refs.

22654 (JINR-E–4-94-123, pp. 31) **N_c behavior of the Adler-Weisberger sum rule.** Wirzba, A. (Technische Hochschule Darmstadt (Germany). Inst. fuer Kernphysik); Kirchbach, M.; Riska, D.O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 7 refs. SUM RULES; COUPLING CONSTANTS; DELTA-1232 BARYONS

22655 (JINR-E–4-94-123, pp. 32) **Zero-point energy corrected solitonic configurations of the semibosonized Nambu and Jona-Lasinio model.** Wuensch, R. (Forschungszentrum Rossendorf e.V. (FZR), Dresden (Germany). Inst. fuer Kern- und Hadronenphysik); Meissner, Th.; Goeke, K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. FLAVOR MODEL/solitons; CENTER-OF-MASS SYSTEM; SOLITONS; MESONS; QUARKS

22656 (JINR-E–4-94-123, pp. 68) **Electroweak excitation of the delta resonance.** Mukhopadhyay, N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DELTA-1232 BARYONS/particle production

22657 (JINR-E–4-94-123, pp. 69) **Mass and width parameters of the $\delta(1232)$ resonance within the framework of a Hamiltonian approach.** Omelaenko, A.S. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DELTA-1232 BARYONS/particle production; MASS; PARTICLE WIDTHS; PHASE SHIFT; PION-NUCLEON INTERACTIONS; SCHWINGER FUNCTIONAL EQUATIONS

22658 (JINR-E–4-94-123, pp. 126) **Discreteness in the hadron mass spectrum.** Sukhoruchkin, S.I. (Peterburgskij Inst. Yadernoj Fiziki, Gatchina (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BARYONS/mass; MESONS/mass; BARYONS; MASS; MASS DIFFERENCE; MESONS

22659 (SLAC–451, pp. 69-94) **TAU Lepton physics at a Tau-Charm Factory.** Perl, M.L. (Stanford Univ., CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. DOE Contract AC03-76SF00515. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

A two-day workshop, "The Tau-Charm Factory in the Era of B-factories and CESR," was held at SLAC in August, 1994. This paper summaries the important research on the tau lepton which could be done at a tau-charm factory in the next decade. It is based on the presentations by the speakers and on the discussion by participants, as well as on published papers.

22660 (SLAC–451, pp. 156-183) **Physics prospects at the Tau-Charm Factory.** Huang, T. (IHEP, Beijing (China)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

In this talk the author summarizes results which have come from the Beijing Electron Positron Collider (BEPC) up to this point in comparison with results from other machines in operations today. He also points out the advantages offered by a new machine tailored as a Tau Charm Factory, where advantage can be taken of resonanaces and threshold phenomena to achieve better accuracy in measurements, and to minimize problems of systematic errors. Physics results which can be addressed in gluonium and hybrid states, in the study of tau particles and its neutrinos, and in the study of charm physics, are discussed.

22661 (SLAC–451, pp. 505-534) **Some important questions in charmonium physics.** Seth, K. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is devoted to three propositions: (1) Some of the most basic questions in heavy-quark physics remain unanswered; (2) Charmonium physics is the best place to address those questions at the required level of precision; (3) A tau-charm factory, with a commensurate state-of-the-art detector, are mandatory for doing the job. While open-charm and tau physics will certainly be done at beauty factories, charmonium physics will not. It must, therefore, form an important part of the physics program at a tau charm factory. With this as an introduction, the author then reviews the status of charmonium studies at this point, and ongoing work, with its projected weaknesses.

22662 (SLAC–451, pp. 720-743) **τ universality and precision measurements.** Rizzo, T. (Stanford Linear Accelerator Center, CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper the author discusses the issue of universality with respect to the tau particle. Present work is trying to attack this by looking at $\tau\nu_\tau W$ and $Z\tau\bar{\tau}$ couplings. Some models predict that non-universality will be such a small effect that it may be only tractable with a device such as a tau-charm factory. The issue of universality has impacts in other electroweak reactions, and in many models. The observation of such effects may require very high luminosity however.

22663 (SSCL-Preprint–116) **Potential motion for Thomas-Fermi non-topological solitons.** Bahcall, S. (Stanford Univ., CA (United States). Dept. of Physics); Lynn, B.W. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1992. 4p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC35-89ER40486. NSF-PHY-8917438. (SU-ITP–92/14). Order Number DE95011212. Source: OSTI; NTIS; INIS; GPO Dep.

In the Thomas-Fermi approximation to theories of coupled fermions and scalars, the equations for spherically-symmetric non-topological solitons have the form of potential motion. This gives a straightforward method for proving the existence of non-topological solitons in a given theory and for finding the constant-density, saturating solutions.

22664 (SSCL-Preprint–167) **On constraints for heavy-meson form factors.** Grinstein, B. (Superconducting Super Collider Lab., Dallas, TX (United States)); Mende, P.F. Superconducting Super Collider Lab., Dallas, TX (United States). Nov 1992. 11p. Sponsored by USDOE, Washington, DC (United States);Sloan (Alfred P.) Foundation, New York, NY (United States). DOE Contract AC35-89ER40486 ; AC02-76ER03130. Order Number DE95011105. Source: OSTI; NTIS; INIS; GPO Dep.

We examine the recent work of de Rafael and Taron where model-independent bounds on the Isgur-Wise function are presented. We first argue that the bounds cannot hold in as much generality as implied. We show that the effects of resonances omitted in their discussion (such as heavy-heavy "onium" states below threshold) modify the bound. The resulting bound is much weaker but may be useful where the size of the additional contribution may be computed or estimated.

22665 (SSCL-Preprint–544) **Exact heavy to light meson form factors in the combined heavy quark, large N_c and chiral limits.** Grinstein, B. (Superconducting Super Collider Lab., Dallas, TX (United States)); Mende, P. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486 ; AC02-76ER03130. Order Number DE95011030. Source: OSTI; NTIS; INIS; GPO Dep.

We demonstrate that the form factors of local operators between a heavy meson state (like the B) and a light pseudoscalar state (like the pion) are given exactly by a single pole form in the combined heavy quark, large N_c (number of colors) and chiral limits. We discuss the deviations from this exact result from finite heavy quark masses, non-zero light quark masses and finite N_c. We comment on some of the numerous implications of this result.

6630 Nuclear Physics

Refer also to citation(s) 22970

6631 Nuclear Structure

Refer also to citation(s) 22571, 22647, 22682, 22687, 22749

22666 (INS–1090) **Prospects of spectroscopy with antiprotonic exotic atoms.** Yamazaki, Toshimitsu. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jan 1995. 14p. Order Number DE95780482. Source: OSTI; NTIS; INIS.

Recently discovered metastable antiprotonic helium atoms have provided a new play ground for high precision spectroscopy of exotic atoms involving antiprotons. The structure, formation and decay of large (n,l) states of p-barHe$^+$ atoms have been studied from delayed antiproton annihilation spectra, and laser resonance spectroscopy has also been established. The present status and future perspectives of this new spectroscopy are reviewed. (author).

22667 (JINR–94-1, pp. 28-29) **Low-temperature nuclear orientation of nuclei far from stability line.** Drevenak, R. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Finger, M.; Finger, M. Jr. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. HEAVY NUCLEI/deformed nuclei; INTERMEDIATE MASS NUCLEI/deformed nuclei; E1-TRANSITIONS; E2-TRANSITIONS; MIXING RATIO; M1-TRANSITIONS; M2-TRANSITIONS; PROBABILITY; SPIN ORIENTATION; TEMPERATURE RANGE 0013-0065 K

22668 (JINR-E–4-94-123, pp. 33) **Discrepancy of the Goldbereger-Treiman relation and the structure of the pion-nucleon form factors.** Bolokhov, A.A. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Zovko, N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of*

abstracts. Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NUCLEONS/form factors; PIONS/form factors; COUPLING CONSTANTS; NUCLEONS; PIONS

22669 (JINR-E–4-94-123, pp. 43) **The covariant approach to the three-hadron systems taking into account the effects of quark-gluon substructure.** Safronov, A.N. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. HADRONS/three-body problem; BAG MODEL; GLUONS; HADRONS; QUARKS; RELATIVISTIC RANGE

22670 (JINR-E–4-94-123, pp. 51) **Quasiclassical long-range effect in three-body system.** Pen'kov, F.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. THREE-BODY PROBLEM/faddeev equations; SEMICLASSICAL APPROXIMATION

22671 (JINR-E–4-94-123, pp. 52) **Resonances of effective long-range interaction in three-body scattering problem.** Pen'kov, F.M.; Takibaev, N.Zh. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RESONANCE PARTICLES/three-body problem; ELASTIC SCATTERING

22672 (JINR-E–4-94-123, pp. 65) **Density dependence of the nucleon resonances masses and widths inside nuclei.** Bianchi, N. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NUCLEI/resonance particles; CROSS SECTIONS; NUCLEI; PHOTONUCLEAR REACTIONS; RESONANCE

22673 (JINR-E–4-94-123, pp. 78) **Excitation of few-nucleon systems accompanied by the meson cooling.** Komarov, V.I.; Petrus, A.Yu.; Muller, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LIGHT NUCLEI/collective excitations; CLUSTER MODEL; MESONS; NUCLEONS

22674 (JINR-E–4-94-123, pp. 92) **Frame dependence of nuclear operators.** Adam, J.Jr. (Mainz Univ. (Germany). Inst. fuer Kernphysik); Arenhoevel, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. CURRENT COMMUTATORS/relativistic range; CORRECTIONS; HAMILTONIANS

22675 (JINR-E–4-94-123, pp. 96) **Three-nucleon electromagnetic current.** Kotiyar, V. (NSC Kharkov Inst. of Physics and Technology (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. NUCLEONS/three-body problem; CURRENTS; NUCLEAR POTENTIAL; NUCLEONS

22676 (JINR-E–4-94-123, pp. 99) **Relativistic kinetic equations of nuclear matter with mesonic and spin degrees of freedom.** Smolyansky, S.A. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Prozorkevitch, A.V.; Toneev, V.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NUCLEAR MATTER/kinetic equations; COLLISION INTEGRALS; DEGREES OF FREEDOM; MESONS; RELATIVISTIC RANGE; SPIN

22677 (JINR-E–4-94-123, pp. 118) **A hypernuclear program for the nuclotron accelerator.** Avramenko, S.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Belikov, Yu.A.; Golokhvastov, A.I.; Khorozov, S.A.; Kolesnikov, V.I.; Lukstins, J.; Malakhov, A.I.; Reznikov, S.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. HYDROGEN 4/hypernuclei; TRITIUM/hypernuclei; HYPERNUCLEI; RESEARCH PROGRAMS; TRITIUM

22678 (JINR-E–4-94-123, pp. 120) **The Λ hypernuclear spectroscopy with the SKS spectrometer at KEK-PS.** Ajimura, S. (Osaka Univ., Toyonaka (Japan). Dept. of Physics); Aoki, K.; Bhang, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. HYPERNUCLEI/lambda particles; CARBON 12; HYPERNUCLEI; KAONS PLUS; PION PLUS REACTIONS

22679 (JINR-E–4-94-123, pp. 121) **Spectroscopy of the Λ-hypernuclei: progress, problems, prospects.** Majling, L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HYPERNUCLEI/lambda particles; HYPERNUCLEI; KAON MINUS REACTIONS; PION PLUS REACTIONS

22680 (JINR-E–4-94-123, pp. 122) **Mesonic decay of hypernuclei.** Toshio Motoba. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. HYPERNUCLEI/nuclear decay; HYPERNUCLEI; LAMBDA PARTICLES; PIONS

22681 (JINR-E–4-94-123, pp. 123) **High resolution hypernuclear spectroscopy in electroproduction.** Sotona, M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p.

(CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. HYPERNUCLEI/lambda particles; ENERGY LEVELS; HYPERNUCLEI

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

Refer also to citation(s) 22667, 22680

22682 (FEI–2357) **Effect of nuclear friction on the electromagnetic decay of collective vibrational states of heated spherical nuclei.** Svin'in, I.R. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 11p. (In Russian). Order Number DE95634090. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of nuclear friction on the line form of the electromagnetic radiation generated by surface oscillations of heated spherical nuclei and on the initial state decay law is investigated. It is shown that the decay law differs from the exponential law, the line has the Lorentz form and its width is equal to the sum of the natural width and the friction coefficient. 10 refs.

22683 (JINR–94-1, pp. 14-15) **Effect of nuclear deformation on probabilities of α-, β- and the transitional region N $\simeq$ 88. Structure of nuclei in γ-transitions in nuclei with (N $\simeq$ 88).** Adam, I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Bonch-Osmolovskaya, N.A.; Gorozhankin, V.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs., 1 fig. ERBIUM 156/nuclear deformation; HOLMIUM 156/nuclear deformation; YTTERBIUM 156/nuclear deformation; ALPHA DECAY; BETA DECAY; GAMMA RADIATION; HALF-LIFE; INTERNAL CONVERSION; ISOMERIC TRANSITIONS; PROBABILITY

22684 (JINR–94-1, pp. 16-17) **Mass determination of unstable isotopes via measurements of β-decay energies.** Gromov, K.Ya. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Kalinnikov, V.G.; Fominykh, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 2 figs. EUROPIUM 142/beta decay; ENERGY SPECTRA; POSITRONS

22685 (JINR–94-1, pp. 18-19) **Study of α-decay in rare earth region.** Chumin, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Gorozhankin, V.M.; Gromov, K.Ya. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs., 4 figs. ACTINIUM 225/alpha decay; ASTATINE 217/alpha decay; FRANCIUM 221/alpha decay; ENERGY LEVELS; ENERGY-LEVEL TRANSITIONS; GAMMA SPECTRA

22686 (JINR–94-1, pp. 42-43) **Investigation of beta-neutrino angular correlation in super allowed beta-decay of short-lived nuclei.** Belikov, C. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Brudanin, V.; Egorov, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. NEON 18/beta decay; OXYGEN 14/beta decay; SULFUR 30/beta decay; ANGULAR CORRELATION; BETA PARTICLES; NEUTRINOS

22687 (JINR-E–4-94-123, pp. 119) **The weak decay of polarized hypernuclei.** Bennhold, C. (George Washington Univ., Washington, DC (United States). Center for Nuclear Studies); Ramos, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. HYPERNUCLEI/nuclear decay; BORON 11; CARBON 12; HELIUM 5; HYPERNUCLEI; LAMBDA PARTICLES

6633 Nuclear Reactions and Scattering, General

Refer also to citation(s) 22687, 22700

22688 (INIS-RU–405, pp. 56-66) **Experimental study of polarization in Japan.** Horikawa, N. (Nagoya Univ. (Japan). Dept. of Physics). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The research works on polarization performed during the past few years in Japan are summarized. Progress briefly reviewed: development of the polarized beam, development of polarization techniques, polarized ion sources and polarized targets, experiments in polarization phenomena. 25 refs.; 18 figs.

22689 (JINR-E–4-94-123, pp. 45) **Low energy $\pi N \to \pi\pi N$ reactions: what to measure, how to treat.** Bolokhov, A.A. (Sankt-Peterburgskij Univ., Sankt-Peterburg (Russian Federation)); Vereshagin, V.V.; Sherman, S.G.; Bohnert, U.; Eyrich, W.; Dillig, M.; Jaekel, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PION-NUCLEON INTERACTIONS/cross sections; MEV RANGE; NUCLEONS; PIONS

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 21221, 21222, 21406, 21746, 21747, 21748, 21749, 22590, 22613, 22614, 22627, 22688

22690 (ANL/PHY/PP–83708) **A-dependence of nuclear transparency in quasielastic A(e,e'p) at high Q^2.** O'Neill, T.G. (California Institute of Technology, Pasadena, CA (United States). W.K. Kellogg Radiation Lab.); Lorenzon, W.; Arrington, J. Argonne National Lab., IL (United States). 1 May 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012220. Source: OSTI; NTIS; INIS; GPO Dep.

The A-dependence of the quasielastic A(e,e'p) reaction has been studied with ^{3}H, C, Fe, and Au nuclei at momentum transfers Q^2 = 1, 3, 5, and 6.8(GeV/c)^2. The authors extract the nuclear transparency T(A,Q^2), a measure of the average probability of escape of a proton from a nucleus A. Several calculations predict a significant increase in T with momentum transfer, a phenomenon known as color transparency. No statistically significant rise is seen for any of the nuclei studied.

22691 (BNL–61515) **Scaling between K^+ and proton production in nucleus-nucleus collisions.** Chen, Ziping; Chasman, C. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950127–9: 11. international

conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95008863. Source: OSTI; NTIS; INIS; GPO Dep.

An empirical scaling involving the production of strange particle K^+ and protons has been observed at each rapidity over a large range covered by the E-802 spectrometer in reactions from minimum biased p+Be to central Si+Au at 14.6 A-GeV/c. This scaling has implications for the temporal evolution in nucleus-nucleus collisions.

22692 (BNL–61518) **Hadron distributions at higher rapidity using the BRAHMS forward spectrometer.** Moskowitz, B. Brookhaven National Lab., Upton, NY (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950127–10: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95008861. Source: OSTI; NTIS; INIS; GPO Dep.

Different conditions, and therefore different physics, are expected to exist over the range of rapidities at RHIC. The BRAHMS Forward Spectrometer will measure identified hadron distributions up to $y \approx 4$, giving it a unique place in the RHIC experimental program.

22693 (BNL–61523) **Recent results from E866.** Videbaek, F. E802 Collaboration. Brookhaven National Lab., Upton, NY (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950127–8: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95008857. Source: OSTI; NTIS; INIS; GPO Dep.

The E866 experimental setup has been upgraded by addition of a forward spectrometer to handle the large multiplicities in central Au+Au collisions at AGS. Furthermore new global detectors have been added to gain insight into the reaction dynamics and enable studies of flow effects. The report presents preliminary rapidity distributions for protons and produced mesons in central collisions. The shape of m_t-spectra of pions is discussed. Examples of the measurements which can be done with a new multiplicity array are presented.

22694 (BNL–61525) **Is there flow at the AGS?.** Wessels, J.P.; Zhang, Yingchao. E877 Collaboration. State Univ. of New York, Stony Brook, NY (United States). Dept. of Physics. [1994]. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada). DOE Contract AC02-76CH00016. (CONF-940169–12: 10. winter workshop on nuclear dynamics, Snowbird, UT (United States), 15-21 Jan 1994). Order Number DE95008866. Source: OSTI; NTIS; INIS; GPO Dep.

We have employed the nearly 4π-calorimetric coverage of the E877 apparatus in order to determine flow in different regions of pseudo-rapidity from the measured transverse energy in Au+Au collisions at 11.4 A·GeV/c. Signatures for the side-splash in the reaction plane at forward and backward rapidities have been established. Indications of a non-zero eccentricity of particles in the reaction plane at mid-rapidity are also found. These observations complement analyses deriving collective longitudinal motion from dN/dy-spectra of protons, kaons, and pions as well as collective transverse motion of the same particles from m_t-spectra at midrapidity.

22695 (BNL–61650) **The measurement of nuclear medium effects with K^+.** Piasetzky, E. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). Brookhaven National Lab., Upton, NY (United States). Aug 1994. 7p. Sponsored by USDOE, Washington, DC (United States);United States-Israel Binational Science Foundation, Jerusalem (Israel). DOE Contract AC02-76CH00016. (CONF-9403225–1: International symposium on medium energy physics, Beijing (China), Mar 1994). Order Number DE95010448. Source: OSTI; NTIS; INIS; GPO Dep.

The total cross sections for K^+ mesons on deuterium and several N=Z nuclei have been measured at several momenta in the range 450–740 MeV/c. The characteristics of the K^+ N interaction make the K^+ an ideal tool for probing the nuclear volume to reveal nuclear medium effects. Measurements of the ratio of the total cross sections per nucleon of $K^+ - A$ to $K^+ d$ are found to lie significantly above those predicted by the usual nuclear medium corrections. This suggests that novel phenomena have been neglected. Models which incorporate such phenomena are discussed, including nucleon 'swelling,' mass rescaling, nuclear pions and relativistic effects.

22696 (CONF-9402139–1) **Stochastic approaches to dynamics of heavy ion collisions, the case of thermal fission.** Boilley, D. (Kyoto Univ. (Japan). Yukawa Inst. for Theoretical Physics); Abe, Y.; Suraud, E.; Ayik, S. Tennessee Technological Univ., Cookeville, TN (United States). 30 Mar 1994. 12p. Sponsored by USDOE, Washington, DC (United States);Japan Society for the Promotion of Science, Tokyo (Japan). DOE Contract FG05-89ER40530. From RIKEN symposium on nuclear dynamics at finite temperature; Tokyo (Japan); Feb 1994. Order Number DE95013488. Source: OSTI; NTIS; INIS; GPO Dep.

In order to study the influence of fluctuations on various phenomena linked to heavy ion collisions, a Langevin equation has been derived from a microscopic model. Parameters entering this equation are completely determined from microscopic quantities characterizing nuclear matter. This equation has been applied to various phenomena at intermediate energies. This paper focuses on large amplitude motions and especially thermal fission. Fission rate is calculated and compared to experimental results.

22697 (DOE/ER/40293–9) **Nuclear structure studies via neutron interactions. Progress report, 1 July 1994–30 June 1995.** Carlton, R.F. Middle Tennessee State Univ., Murfreesboro, TN (United States). Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40293. Order Number DE95012166. Source: OSTI; NTIS; INIS; GPO Dep.

Neutron total cross section measurements of ^{122}Sn has been analyzed over the energy range 0.013 to 0.310 MeV. The R - matrix analysis has resulted in resonance and average parameters which provide for a complete representation of the neutron entrance the $s_{1/2}$, $p_{1/2}$, and $p_{3/2}$ contributions. The s - and p - neutron strength functions have been determined to be 0.123 ± 0.023 and 2.0 ± 0.200, respectively (in units of 10^{-4}). Limits are placed on level spacings and strength functions for the individual partial wave components. The s - wave potential scattering radius has been determined to be 6.3 ± 0.1 fm. Average scattering functions, deduced from the average parameters, have been used to determine the real well depth of an optical model potential which reproduces these functions. We find, as have others, that the real well depth is parity dependent. Two computer codes were developed: (1) a minimization program for finding parameters of a dispersive optical model which reproduce the high resolution data of the ORELA facility, and (2) an X-windows graphical user interface has been developed to permit interactive resonance analysis of the neutron total cross section data using analysis-and-minimization codes developed previously. These will contribute to the more routine analysis of ORELA data.

22698 (DOE/ER/40702–9) **A cross section measurement of charm hyperons Ξ_c^+ and Ξ_c^0 in 250 GeV p/K/π-nucleon interactions.** Francisco, J.; Vergara, A. Tufts Univ., Medford, MA (United States). Dept. of Physics and Astronomy. 2 May 1995. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40702. Order Number DE95013071. Source: OSTI; NTIS; INIS; GPO Dep.

Fermilab Experiment 769 used a charge-selected, hadron beam of mean energy 250 GeV/c, composed of pions, kaons, and protons, impinging on beryllium, aluminum, copper and tungsten targets. Using a sample of approximately 4000 $\Xi_c^- \rightarrow \Lambda^0\pi^-$ decays, measurements of the charm baryon forward cross sections times branching ratio $\pi^{\pm}N \rightarrow \Xi_c^+X$ and $\pi^{\pm}N \rightarrow \Xi_c^0X$ are presented. Upper limits on α x BR are also determined for the states $\Xi_c^+ \rightarrow \Xi_c^-\pi^+\pi^+$ and $\Xi_c^0 \rightarrow \Xi_c^-\pi^+$ produced in (p, π^+, π^-, K^+, K^-)-nucleon interactions.

22699 (DOE/ER/40808–T1) **Low energy proton capture in light nuclei. Progress report, September 1, 1993–June 8, 1994.** Prior, R.M. West Georgia Coll., Carrollton, GA (United States). Dept. of Physics. [1995]. 9p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract FG05-93ER40808. Order Number DE95012197. Source: OSTI; NTIS; INIS; GPO Dep.

Radiative capture reactions with light nuclei are of special interest in nuclear astrophysics because of their importance in the formation of the various elements. In many cases a simple direct-capture model that considers only the electromagnetic interaction is sufficient to reproduce experimental results. A direct-semidirect process may be used in which the transition amplitude is the sum of a direct term and another term representing the excitation of the target nucleus into a collective state. In cases where these approaches are not sufficient, the relative simplicity of nuclear systems with small numbers of fundamental particles allows microscopic calculations of measurable quantities from nucleon-nucleon potentials, using the multichannel resonating group model or, in some cases, Faddeev calculations. In the summer of 1990, the PI began a collaboration with Professor Henry Weller's group at the Triangle Universities Nuclear Laboratory (TUNL). Weller's group has studied radiative capture reactions with polarized beams at TUNL for over a decade, developing considerable expertise in the detection of high energy gamma rays and for the analysis of the measurements. The PI has been involved in the development of a new series of experiments at beam energies below 100 keV, using the positive beam directly from the high intensity atomic beam polarized ion source. This work is the topic of the present grant, which began September 1, 1993. The main activity in the grant occurs during the summer months. Since this is the first year of the grant, most of that activity will be during the upcoming summer months. The PI will travel to TUNL in mid-June and will spend most of his time from then through August either at TUNL or working on data reduction and other calculations at West Georgia College. The PI is moving from West Georgia College (WGC) to North Georgia College (NGC) in September, 1994. He will be Professor and Chair of Physics there as he has been at WGC.

22700 (FEI–2381) **Application of optical potential theory for calculation of nucleon cross sections.** Avdeenkov, A.V.; Kamerdzhiev, S.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 25p. (In Russian). Order Number DE95634124. Source: OSTI; NTIS (US Sales Only); INIS.

In order to calculate cross sections more reliably, application of the Green function method to the calculation of the optical nucleon potential V_{opt} is treated. A semi-microscopic approach for calculation of V_{opt} based on using the available theoretical information about the mass operator and the known phenomenological V_{opt} is proposed. The main part of Im V_{opt} for neutrons with $E_n<10$ MeV as well as the absorption cross section for s- and p-neutron for ^{208}Pb have been calculated. Several variants to improve the available calculations of V_{opt} and, therefore, cross sections including those for non-magic and hot nuclei are proposed. 29 refs.; 5 figs.

22701 (FEI–2390) **Effect of nuclear level density on the calculation of excitation function for production of cesium, xenon, iodine, thallium, lead and bismuth radionuclides.** Kurenkov, N.V.; Lunev, V.P.; Shubin, Yu.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 52p. (In Russian). Order Number DE95634109. Source: OSTI; NTIS (US Sales Only); INIS.

Excitation functions for the production of radionuclides Cs, Xe, I, Pb, Tl, Bi and some others for charged particle energies ranging from 5-100 MeV have been calculated. The well known experimental results have been compared to excitation functions calculated by two versions of the most widely used computer code ALICE. The generalized superfluid model of nuclei was used for level density description. The results of calculation for the ALICE-87 and ALICE-92 codes are discussed. Modified ALICE-92 code takes into account γ-ray competition, as well as cluster's preequilibrium emission. 43 refs.; 29 figs.; 3 tabs.

22702 (FEI–2402) **Analysis of threshold anomaly in elastic and inelastic proton scattering.** Gurbich, A.F.; Titarenko, N.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 12p. (In Russian). Order Number DE95634125. Source: OSTI; NTIS (US Sales Only); INIS.

Numerical experiments have been performed with aim to reveal the influence of channel coupling and peculiarities of the real optical potential formfactor on the experimentally obtainable values. High sensitivity of the inelastic scattering cross section to the detailed structure of the real potential well is shown. Effects of the channel coupling have not been revealed. 18 refs.; 5 figs.; 1 tab.

22703 (INIS-RU–405, pp. 144-147) **Polarization effects in diffractive disintegration of relativistic deuterons.** Rekalo, M.P.; Gakh, G.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Deuteron diffractive dissociation is investigated. for extracting information on the deuteron structure and for determination of behaviour of S and D-components of the deuteron wave function at short distances. The dynamics of the deuteron diffractive disintegration is described in terms of Feynman diagrams treated relativistically, when the nucleons are described by the four-components Dirac spinors and deuteron is by the polarization 4-vector. 5 figs.

22704 (INIS-RU–405, pp. 214-216) **Rotation and spin oscillation of high-energy particles in target with polarized nuclei and possibility of measurement of spin-dependent part amplitude of coherent elastic forward scattering.** Baryshevskij, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

For measurement of spin-dependent amplitude of coherent elastic scattering of slow neutrons by nucleus at zero angle the nuclear precession of neutron spin in matter with polarized nuclei is used. 7 refs.

22705 (INIS-RU–405, pp. 288-290) **The p$_t$-dependence of asymmetry in inclusive π^0-production in the beam fragmentation region at 40 GeV.** Apokin, V.D. (and others); belikov, N.I.; Chujko, B.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The π^0-meson asymmetry measured in the reactions is presented. The asymmetry unpolarized beam fragmentation region at intermediate was measured for the first time. 11 refs.

22706 (INIS-RU–405, pp. 329-332) **The vector analyzing power 1 T_{11} in the π^+d->pp reaction in the energy region 350-450 MeV.** Bazhanov, N.A. (and others); Efimovich, V.A.; Fedorov, O.Ya. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The measurement of vector analyzing power in the πd->pp region 350-450 MeV was carried out on the synchrocyclotron pion beam using the deuteron polarized target and scintillation counter hodoscopes. 9 refs.

22707 (INIS-RU–405, pp. 333-341) **Polarization study of the deuteron photodisintegration reaction in the δ(1232)-resonance region.** Konovalov, O.G.; Marekhin, S.V.; Sorokin, P.V.; Storozhenko, Yu.O. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The results of proton polarization measurements in the deuteron photodisintegration in the energy range E_γ=200-350 MeV are presented. 20 refs.

22708 (INIS-RU–405, pp. 342-345) **Studies on polarization phenomena in the deuteron electrodisintegration.** Mel'nik, Yu.P.; Shebeko, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Dependences of the azimuthal and target asymmetries in the break-up polarized deuterons by unpolarized deuterons on the choice of deuteron EM. Results of the calculations are compared with available data. 4 refs.

22709 (INIS-RU–405, pp. 346-348) **Mechanism of the ^{2}He breakup by linearly polarized photons.** Kotyar, V.V.; Shebeko, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

In this report the effects of the two-body photoabsorption mechanism generated by the ρ-meson exchange are demonstrated against the background of contributions arising from the convection current, the magnetic current and π-EC. 16 refs.

22710 (INIS-RU–405, pp. 349-352) **Elastic p-^{4}He scattering at intermediate energies.** Manaenkov, S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper the description of an elastic p-^{4}He scattering with NN-amplitudes obtained in the phase shift analysis and realistic wave functions are given. 8 refs.

22711 (INIS-RU–405, pp. 353-358) **The prospect of experimental study an analysing power of polarized proton scattering on carbon.** Belzer, L.I. (and others); Bodyagin, V.A.; Gribushin, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Data on analyzing power of polarized proton scattering on carbon at the energies 1-3 GeV are obtained for first time. 11 refs.

22712 (INIS-RU–405, pp. 359-362) **Elastic and inelastic electron scattering on polarized deuterons.** Vojtsekhovskij, B.B. (and others); Nishnev, V.I.; Nikolaenko, D.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics*. Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

On VEPP-3 storage rings in Novosibirsk the experiments on electron scattering on polarized deuterons has been set up. The experiment at high momentum transfer has been developed. 3 refs.

22713 (INS–1082) **Nucleosynthesis in explosive hydrogen burning process.** Kubono, Shigeru. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1994. 9p. Order Number DE95780480. Source: OSTI; NTIS; INIS.

Some experimental studies of light, proton-rich unstable nuclei have been performed to investigate the onset mechanism of the rapid-proton process including the breakout processes from the Hot-CNO cycle and also from the NeNa cycle. A new experimental result on the Ne-E problem is also discussed. The INS project is briefly reported that uses radioactive nuclear beams for nuclear astrophysics. (author).

22714 (INS–1083) **Recent development in experimental nuclear astrophysics.** Kubono, S. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1994. 11p. Order Number DE95780481. Source: OSTI; NTIS; INIS.

Some critical nuclear reactions in nuclear astrophysics are discussed. They include the problems in primordial nucleosynthesis, the solar neutrino problem, ^{16}O synthesis in He burning, and the explosive hydrogen burning process. Specifically, astrophysical nuclear reactions which involve clusters and unstable nuclei are emphasized. The scope of the field is also discussed. (author) 64 refs.

22715 (JAERI-Tech–95-004) **Calculation of air activation in an electron linac facility using the EGS4 code system.** Endo, Akira (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 24p. Order Number DE95780483. Source: OSTI; NTIS; INIS.

Calculations were performed to estimate the concentrations of ^{11}C, ^{13}N and ^{15}O induced through the photonuclear reaction in the air of a target room of an electron linear accelerator facility. The angular distributions of bremsstrahlung spectra from a thick-copper target struck with 100 MeV electrons were estimated using a Monte Carlo code EGS4, and a significant air region where the photonuclear reactions of the air nuclei occur was identified. By use of the photon spectrum in this region, the concentrations of ^{11}C, ^{13}N and ^{15}O were calculated and compared with the experimental results. The calculated values agreed with the measured values within a factor 2. (author).

22716 (JINR–94-1, pp. 24-25) **Investigation of spin-neutron angular correlations in processes of capture of polarized muons by light nuclei.** Brudanin, V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Egorov, V.; Kachalkin, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. SILICON 28 TARGET/muon reactions; ALUMINIUM 28; ANGULAR CORRELATION; CAPTURE; DSA METHOD; GAMMA RADIATION; MEV RANGE 01-10; NEUTRINOS; POLARIZED BEAMS; SPIN ORIENTATION

22717 (JINR–94-1, pp. 32-33) **Study of antiproton and antineutron annihilations at LEAR with OBELIX detector.** Ableev, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Denisov, O.Yu.; Gorchakov, O.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. ANTIPROTON REACTIONS/annihilation; DEUTERIUM TARGET/antiproton reactions; ANNIHILATION; INCLUSIVE INTERACTIONS; LAMBDA PARTICLES; MASS SPECTRA; MEV RANGE 100-1000; PARTICLE PRODUCTION; PIONS MINUS; PIONS PLUS; PROTONS

22718 (JINR–94-1, pp. 50-51) **Study of subthreshold pion production and high energy light fragments emission in nucleus-nucleus collisions at heavy ion accelerators of the Laboratory of Nuclear Reactions of JINR.** Oganesyan, K.O. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Pasyuk, E.A.; Aleksakhin, V.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. ALUMINIUM 27 TARGET/oxygen 16 reactions; PIONS/particle production; DIFFERENTIAL CROSS SECTIONS; MEV RANGE 100-1000; PIONS; PROTON SPECTRA; PROTONS

22719 (JINR–94-1, pp. 52-53) **Study of low energy pion-nucleus interaction at LAMPF.** Oganesyan, K. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Pasyuk, E.; Aleksakhin, V.Yu.; Gogolev, S.I.; Kurepin, A.; Morris, C.; Ritchie, B.; Ransome, R. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. DEUTERIUM TARGET/pion reactions; CROSS SECTIONS; GAMMA RADIATION; MEV RANGE 10-100; NEUTRONS; PROTONS

22720 (JINR–94-1, pp. 80-81) **Investigation of the multifragmentation of target nuclei in nucleus-nucleus collisions at intermediate and high energies.** Karnaukhov, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Petrov, L.A.; Kuznetsov, V.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. GOLD 197 TARGET/alpha reactions; BREAKUP REACTIONS; GEV RANGE 01-10; GEV RANGE 10-100; MULTIPLICITY; NUCLEAR FRAGMENTS

22721 (JINR-E–4-94-123, pp. 39) **Meson exchange potential with quark core predicts exotics.** LaFrance, P. (Quebec Univ., Montreal, PQ (Canada)); Lomon, E.L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs. EXOTIC RESONANCES/quark model; EXCHANGE INTERACTIONS; NUCLEON-NUCLEON INTERACTIONS; NUCLEON-NUCLEON POTENTIAL

22722 (JINR-E–4-94-123, pp. 40) **Relativistic approach to final-state interaction in deuteron electrodisintegration.** Rekalo, M. (Natsional'nyj Nauchnyj Tsentr Khar'kovskij Inst. Fiziki i Tekhnologii, Khar'kov (Ukraine)); Gakh, G.; Rekalo, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs. DEUTERIUM TARGET/electron reactions; BREAKUP REACTIONS; ELECTRONS; FINAL-STATE INTERACTIONS; PROTONS; RELATIVISTIC RANGE; SPIN ORIENTATION

22723 (JINR-E–4-94-123, pp. 42) **On the field-theoretical scattering theory on the deuteron electromagnetic reactions.** Machavariani, A.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. DEUTERIUM TARGET/electron reactions; DEUTERIUM TARGET/photonuclear reactions; AMPLITUDES; ELECTRONS; NUCLEONS; VERTEX FUNCTIONS

22724 (JINR-E–4-94-123, pp. 44) **The $d+^{Z}A\rightarrow^{Z+1}(A+2)+2\pi$ reaction in CELSIUS and the effective pion-pion interaction.** Bargholtz, Chr. (Stockholm Univ. (Sweden). Dept. of Physics); Fransson, Kj.; Holmberg, L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. DEUTERIUM TARGET/deuteron reactions; CROSS SECTIONS; MEV RANGE 10-100; MEV RANGE 100-1000; PION-PION INTERACTIONS

22725 (JINR-E–4-94-123, pp. 66) **δ excitations in nuclei and their decay properties.** Korfgen, B.; Oltmanns, P.; Osterfeld, F.; Udagawa, T. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CARBON 12 TARGET/helium 3 reactions; CARBON 12 TARGET/photonuclear reactions; CROSS SECTIONS; DELTA BARYONS; PARTICLE PRODUCTION

22726 (JINR-E–4-94-123, pp. 67) **Investigation of the pion electroproduction in the ^{4}He (e,e') reaction.** Kuplennikov, E.L. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Ganu, A.V.; Jager, C.W.; Mazhichenko, S.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HELIUM 4 TARGET/electron reactions; PIONS/electroproduction; CROSS SECTIONS; GEV RANGE 01-10; PIONS; ELECTROPRODUCTION

22727 (JINR-E–4-94-123, pp. 70) **δresonance decay and absorption in nuclei.** Ramastein, B. (and others); Rousteau, S.; Hennino, T. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HELIUM 4 TARGET/helium 3 reactions; LEAD 208 TARGET/helium 3 reactions; DELTA BARYONS; PARTICLE DECAY; TRITONS

22728 (JINR-E–4-94-123, pp. 71) **Study of the reaction π^{+}d->pp between 20 and 45 MeV.** Alexakhin, V.Yu.; Gogolev, S.I.; Oganesyan, K.O.; Pasyuk, E.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DEUTERIUM TARGET/pion plus reactions; CROSS SECTIONS; MEV RANGE 10-100

22729 (JINR-E–4-94-123, pp. 73) **Energetic products as pions and high energy protons in heavy ion collisions, evidence for coherent production.** Badala, A. (and others); Barbers, R.; Palmeri, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ALUMINIUM 27 TARGET/oxygen 16 reactions; GOLD 197 TARGET/oxygen 16 reactions; NICKEL 58 TARGET/oxygen 16 reactions; GEV RANGE 01-10; PARTICLE PRODUCTION; PIONS; PROTONS

22730 (JINR-E–4-94-123, pp. 74) **Neutral pions as probes of nuclear dynamics in heavy ion collisions at intermediate energies.** Badala, A. (and others); Barbera, R.; Palmeri, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ARGON 36 REACTIONS; PIONS NEUTRAL/particle production; GEV RANGE 01-10

22731 (JINR-E–4-94-123, pp. 76) **Studies of (p,π) and (p2π) reactions on the Indiana Cooler ring using recoil-ion detection.** Bent, R.D. (and others). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CARBON 12 TARGET/proton reactions; PARTICLE PRODUCTION; PIONS

22732 (JINR-E–4-94-123, pp. 77) **Study of near-threshold charged and neutral meson production in nucleus-nucleus collisions at the delta-installation on Dubna Nuclotron.** Krasnov, V.A. (AN SSSR, Moscow (Russian Federation). Inst. Yadernykh Issledovanij); Malakhov, A.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HEAVY ION REACTIONS; SCALAR MESONS/particle production; VECTOR MESONS/particle production

22733 (JINR-E–4-94-123, pp. 80) **Physics of the (p,p'π) reaction.** Londergan, J.T. (Indiana Univ. of Pennsylvania, IN (United States). Dept. of Physics); Mehrem, R.; Waller, G.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PROTON REACTIONS/direct reactions; CROSS SECTIONS; LIGHT NUCLEI; MEV RANGE 100-1000; PIONS; PROTONS

22734 (JINR-E–4-94-123, pp. 82) **Photoabsorption in heavy nuclei at intermediate energies.** Nedorezov, V.G. (Inst. for Nuclear Research, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NEPTUNIUM 237/photonuclear reactions; URANIUM 238/photonuclear reactions; CROSS SECTIONS

22735 (JINR-E–4-94-123, pp. 83) **Pion-induced fission.** Peterson, R.J. (Colorado Univ., Boulder, CO (United States). Nuclear Physics Lab.). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. FISSION/pion reactions; FISSION; MEV RANGE 100-1000; PROBABILITY

22736 (JINR-E–4-94-123, pp. 84) **Why the $\pi^- \rightarrow \gamma nn$ and nn experiments are interesting?.** Pupyshev, V.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Solovtsova, O.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs., 2 figs. DEUTERIUM TARGET/pion minus reactions; ENERGY DEPENDENCE; NEUTRONS; PARTIAL WAVES; PHASE SHIFT; PHOTONS

22737 (JINR-E–4-94-123, pp. 85) **Coherent meson production via Cherenkov effects in high-energy nucleus-nucleus collisions.** Stocker, W. (Muenchen Univ. (Germany). Sektion Physik); Ion, D.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. HEAVY ION REACTIONS; PHOTONS/coherent production; PIONS/coherent production; CHERENKOV RADIATION; PHOTONS; PIONS

22738 (JINR-E–4-94-123, pp. 86) **Inclusive pion double charge exchange on light nuclei at intermediate energies.** Abramov, B.M. (Inst. of Theoretical and Experimental Physics, Moscow (Russian Federation)); Dukhovskoy, I.A.; Fedorets, V.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. LIGHT NUCLEI/pion reactions; CHARGE-EXCHANGE REACTIONS; MEV RANGE 100-1000; PIONS PLUS

22739 (JINR-E–4-94-123, pp. 87-88) **Analog isospin giant resonances excited by single pion charge exchange reactions.** Hanna, S.S. (Stanford Univ., CA (United States). Dept. of Physics). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 2 figs. CARBON 13 TARGET/pion plus reactions; CHARGE-EXCHANGE REACTIONS; DIFFERENTIAL CROSS SECTIONS; ISOSPIN; NITROGEN 13; PIONS NEUTRAL

22740 (JINR-E–4-94-123, pp. 89) **Unified microscopic theory of pion nucleus scattering.** Kagarlis, M.A. (Niels Bohr Inst., Copenhagen (Denmark)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PION REACTIONS/charge-exchange reactions; ELASTIC SCATTERING; INELASTIC SCATTERING

22741 (JINR-E–4-94-123, pp. 90) **Effect of pion distortion on low-energy pion-double-charge exchange.** Khankhasayev, M.Kh. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Kurmanov, Zh.B.; Sarafian, H.; Johnson, M.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. PION REACTIONS/charge-exchange reactions; QUASI-ELASTIC SCATTERING; SCATTERING AMPLITUDES

22742 (JINR-E–4-94-123, pp. 91) **Effects of pion internal distortion on low-energy pion double charge exchange.** Sarafian, H. (Pennsylvania State Univ., York, PA (United States). Dept. of Physics); Johnson, M.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. PION REACTIONS/charge-exchange reactions

22743 (JINR-E–4-94-123, pp. 93) **Subnuclear and relativistic effects in the nuclear current operator.** Arenhoevel, H. (Mainz Univ. (Germany). Inst. fuer Kernphysik). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. DEUTERIUM TARGET/electron reactions; BREAKUP REACTIONS; CORRECTIONS; QUANTUM OPERATORS; RELATIVISTIC RANGE

22744 (JINR-E–4-94-123, pp. 94) **Signature of MEC in the process ^{6} Li(γ, n p)α.** Burkova, N.A. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (Kazakhstan)); Kuchina, E.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. LITHIUM 6 TARGET/photonuclear reactions; ALGEBRAIC CURRENTS; ALPHA PARTICLES; MEV RANGE 10-100; MEV RANGE 100-1000; NEUTRONS; PROTONS

22745 (JINR-E–4-94-123, pp. 95) **Meson exchange current effects studied by nuclear Compton scattering.** Falkenberg, H. (Goettingen Univ. (Germany). 3. Physikalisches Inst.); Glebe, T.; Haeger, D.; Huenger, A.; Huett, M.; Kraus, A.; Schumacher, M.; Selke, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HEAVY ION REACTIONS/compton effect; ALGEBRAIC CURRENTS; OPE MODEL

22746 (JINR-E–4-94-123, pp. 97) **On deuteron photodisintegration in the diagrammatical approach.** Levchuk, M.I. (Inst. of Physics, Belarus Academy of Sciences, Minsk (Belarus)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. DEUTERIUM TARGET/photonuclear reactions; BREAKUP REACTIONS; CURRENTS; OPE MODEL

22747 (JINR-E–4-94-123, pp. 98) **Role of mesons in intermediate states for polarization phenomena in fragmentation processes of deuteron.** Lykasov, G.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Dorodnykh, Yu.L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. DEUTERON REACTIONS/nuclear fragmentation; MESONS; PROTONS; SPIN ORIENTATION

22748 (JINR-E–4-94-123, pp. 100) **Calculation of the pion photoproduction of ^{6} Li in the framework of a α-2 N model.** Eramshyan, R.A. (Inst. for Nuclear Research of the Russian Academy of Sciences, Moscow (Russian Federation)); Ryshikh, G.G.; Kamalov, S.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 2 figs. LITHIUM 6 TARGET/photonuclear reactions; PIONS PLUS/photoproduction; ANGULAR DISTRIBUTION; CLUSTER MODEL; DIFFERENTIAL CROSS SECTIONS; MEV RANGE 10-100; MEV RANGE 100-1000; PHOTOPRODUCTION

22749 (JINR-E–4-94-123, pp. 102) **Studies of γ-decays of the ^{12} B excited bound states at the ^{12} C(γ, π^{+})^{12} B-reaction.** Kashevarov, V.L. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.); Kravtsov, A.V.; Lebedev, A.I.; Pavlyuchenko, L.N.; Sidorin, S.S.; Sokol, G.A.; Tryasuchev, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. BORON 12/gamma decay; CARBON 12 TARGET/photonuclear reactions; ANGULAR DISTRIBUTION; PIONS PLUS

22750 (JINR-E–4-94-123, pp. 105) **Study of retardation effects in γA-scattering within relativistic oscillator model.** L'vov, A.I. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.); Milstein, A.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PHOTONUCLEAR REACTIONS/harmonic oscillator models; RELATIVISTIC RANGE; SCATTERING AMPLITUDES

22751 (JINR-E–4-94-123, pp. 106) **Theory of the elastic γ He^{4}-scattering retardation effects and exchange currents.** L'vov, A.I. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.); Petrun'kin, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 refs. HELIUM 4 TARGET/photonuclear reactions; ALGEBRAIC CURRENTS; CROSS SECTIONS; ELASTIC SCATTERING; SCATTERING AMPLITUDES

22752 (JINR-E–4-94-123, pp. 108) **Photoproduction of η-nuclei.** Kashevarov, V.L. (AN SSSR, Moscow (Russian Federation). Fizicheskij Inst.); Lebedev, A.I.; Pavlyuchenko, L.N.; Sokol, G.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 5 refs. NUCLEI/eta mesons; NUCLEI; OXYGEN 16 TARGET; PHOTONUCLEAR REACTIONS

22753 (JINR-E–4-94-123, pp. 109) **The pd $\rightarrow$ ^{3} Heη reaction at threshold and the possibility of presence of quasi-bound η - ^{3} He state.** Kondratyuk, L.A. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (Kazakhstan)); Lado, A.V.; Uzikov, Yu.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 5 refs. DEUTERIUM TARGET/proton reactions; ETA MESONS; HELIUM 3; PROTON-PROTON INTERACTIONS; QUASIBOUND STATE; THRESHOLD ENERGY

22754 (JINR-E–4-94-123, pp. 110) **Study of N* resonances by η photoproduction.** Krusche, B. (Giessen Univ. (Germany)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. ETA MESONS/photoproduction; PHOTOPRODUCTION; N*BARYONS; PHOTON-PROTON INTERACTIONS; PHOTONUCLEAR REACTIONS

22755 (JINR-E–4-94-123, pp. 112) **The ηN N coupling in η photoproduction on the nucleon.** Tiator, L. (Mainz Univ. (Germany). Inst. fuer Kernphysik); Bennhold, C.; Kamalov, S.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. ETA MESONS/photoproduction; BOUND STATE; PHOTOPRODUCTION; NUCLEONS; PHOTONUCLEAR REACTIONS; PION REACTIONS

22756 (JINR-E–4-94-123, pp. 114) **Meson-nucleus interaction in antiproton annihilation on nuclei.** Sibirtsev, A.A. (Inst. of Theoretical and Experimental Physics, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ANTIPROTON REACTIONS/annihilation; MESON REACTIONS; ANNIHILATION

22757 (JINR-E–4-94-123, pp. 115) **Investigation of subthreshold K^+ production in P + A reactions with the O^0 facility at COSY-Juelich.** Buescher, M. (Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik); Schult, O.W.B.; Sistemich, K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs. KAONS PLUS/particle production; CROSS SECTIONS; PROTON REACTIONS

22758 (JINR-E–4-94-123, pp. 116) **Subthreshold K^- production in pion-nucleus reactions.** Efremov, S.V. (Rice Univ., Houston, TX (United States). Bonner Nuclear Labs.); Paryev, E.Ya. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. KAONS PLUS/particle production; CROSS SECTIONS; PROTON REACTIONS

22759 (JINR-E–4-94-123, pp. 117) **The effects of one-particle continuum in (K^-, π^-) and (π^+, K^+) reactions.** Knyr, V.A. (Khabarovsk State Technical Univ., Khabarovsk (Russian Federation)); Mazur, A.I.; Smirnov, Yu.F. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. KAON MINUS REACTIONS; OXYGEN 16/hypernuclei; PION PLUS REACTIONS; CROSS SECTIONS; KAONS PLUS; LAMBDA PARTICLES; HYPERNUCLEI; OXYGEN 16 TARGET; PIONS MINUS

22760 (LA–12556-C, pp. 212-215) **Nuclear Criticality Safety Technology Project physics criteria for benchmarks.** Westfall, M. (Oak Ridge National Lab., TN (United States)). Los Alamos National Lab., NM (United States). Sep 1994. (CONF-9205206–: DOE nuclear criticality safety technology project workshop, Gaithersburg, MD (United States), 12-14 May 1992). In *Proceedings of the first annual Nuclear Criticality Safety Technology Project.* 251p. Order Number DE95000557. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this paper was an overview of the breakout session on the physics criteria needed for benchmarking. Contents included a listing of attendees and the physics criteria workgroup session as well as the accident analysis workgroup session.

22761 (LA-SUB–95-3) **[Fission product yields of 60 fissioning reactions]. Final report.** Rider, B.F. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011620. Source: OSTI; NTIS; INIS; GPO Dep.

In keeping with the statement of work, I have examined the fission product yields of 60 fissioning reactions. In co-authorship with the UTR (University Technical Representative) Talmadge R. England "Evaluation and Compilation of Fission Product Yields 1993," LA-UR-94-3106(ENDF-349) October, (1994) was published. This is an evaluated set of fission product Yields for use in calculation of decay heat curves with improved accuracy has been prepared. These evaluated yields are based on all known experimental data through 1992. Unmeasured fission product yields are calculated from charge distribution, pairing effects, and isomeric state models developed at Los Alamos National Laboratory. The current evaluation has been distributed as the ENDF/B-VI fission product yield data set.

22762 (LA-UR–95-1341) **Multilevel fitting of ^{235}U resonance data sensitive to Bohr-and Brosa-fission channels.** Moore, M.S. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950478–1: International conference on nuclear spectroscopy and nuclear structure, Dubna (Russian Federation), 4-7 Apr 1995). Order Number DE95012066. Source: OSTI; NTIS; INIS; GPO Dep.

The recent determination of the K, J dependence of the neutron induced fission cross section of ^{235}U by the Dubna group has led to a renewed interest in the mechanism of fission from saddle to scission. The K quantum numbers designate the so-called Bohr fission channels, which describe the fission properties at the saddle point. Certain other fission properties, e.g., the fragment mass and kinetic-energy distribution, are related to the properties of the scission point. The neutron energy dependence of the fragment kinetic energies has been measured by Hambsch et al., who analyzed their data according to a channel description of Brosa et al. How these two channel descriptions, the saddle-point Bohr channels and the scission-point Brosa channels, relate to one another is an open question, and is the subject matter of the present paper. We use the correlation coefficient between various data sets, in which variations are reported from resonance to resonance, as a measure of both-the statistical reliability of the data and of the degree to which different scission variables relate to different Bohr channels. We have carried out an adjustment of the ENDF/B-VI multilevel evaluation of the fission cross section of ^{235}U, one that provides a reasonably good fit to the energy dependence of the fission, capture, and total cross sections below 100 eV, and to the Bohr-channel structure deduced from an earlier measurement by Pattenden and Postma. We have also further explored the possibility of describing the data of Hambsch et al. in the Brosa-channel framework with the same set of fission-width vectors, only in a different reference system. While this approach shows promise, it is clear that better data are also needed for the neutron energy variation of the scission-point variables.

22763 (LBL–36651) **The α-induced thick-target γ-ray yield from light elements.** Heaton, R.K. (Queen's Univ., Kingston, ON (Canada). Dept. of Physics). Lawrence Berkeley Lab., CA (United States). Oct 1994. 228p. Sponsored by USDOE, Washington, DC (United States);Natural Sciences and Engineering Research

Council of Canada, Ottawa, ON (Canada). DOE Contract AC03-76SF00098. Order Number DE95011263. Source: OSTI; NTIS; INIS; GPO Dep.

The α-induced thick-target γ-ray yield from light elements has been measured in the energy range 5.6 MeV $\leq E_\alpha \leq$ 10 MeV. The γ-ray yield for > 2.1 MeV from thick targets of beryllium, boron nitride, sodium fluoride, magnesium, aluminum and silicon were measured using the α-particle beam from the Lawrence Berkeley Laboratories 88 in. cyclotron. The elemental yields from this experiment were used to construct the α-induced direct production γ-ray spectrum from materials in the SNO detector, a large volume ultra-low background neutrino detector located in the Creighton mine near Sudbury, Canada. This background source was an order of magnitude lower than predicted by previous calculations. These measurements are in good agreement with theoretical calculations of this spectrum based on a statistical nuclear model of the reaction, with the gross high energy spectrum structure being reproduced to within a factor of two. Detailed comparison of experimental and theoretical excitation population distribution of several residual nuclei indicate the same level of agreement within experimental uncertainties.

22764 (LBL–36883) **First results from NA49 on Pb+Pb collisions at 158 GeV/nucleon.** Margetis, S. NA49 Collaboration. Lawrence Berkeley Lab., CA (United States). Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States);Polish State Committee for Scientific Research (Poland);Bundesministerium fuer Forschung und Technologie, Bonn (Germany);Polish-German Foundation;Athens Univ. (Greece). DOE Contract AC03-76SF00098. (CONF-950127–11: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95012326. Source: OSTI; NTIS; INIS; GPO Dep.

First results from the NA49 experiment with a ^{208}Pb beam on a Pb target at the CERN SPS with total energy of 33 TeV are presented. Data on transverse energy production, forward energy flow and rapidity density of negative hadrons are shown and discussed. The degree of nuclear stopping and the energy densities achieved are estimated for near head-on collisions.

22765 (LBL–37020) **Strange particle measurements from the EOS TPC.** Justice, M. Lawrence Berkeley Lab., CA (United States). Feb 1995. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098 ; FG02-89ER40531 ; FG02-88ER40408 ; FG02-88ER40412 ; FG05-88ER40437. PHY9123301. (CONF-950191–1: 23. international winter meeting on nuclear physics, Bormio (Italy), 23-28 Jan 1995). Order Number DE95012327. Source: OSTI; NTIS; INIS; GPO Dep.

EOS Collaboration.

A high statistics sample of Λ's produced in 2 GeV/nucleon ^{58}Ni + ^{nat}Cu collisions has been obtained with the EOS Time Projection Chamber at the Bevalac. The coverage of the EOS TPC is essentially 100% for $y > y_{cm}$ and extends down to $P_T = 0$ where interesting effects such as collective radial expansion may be important. In addition, the detection of a majority of the charged particles in the TPC, along with the presence of directed flow for protons and heavier fragments at this beam energy, allows for the correlation of A production with respect to the event reaction plane. Our preliminary analysis indicates the first observation of a sidewards flow signature for A's. Comparisons with the cascade code ARC are made.

22766 (UCRL-ID–119181) **High energy heavy ion experiments.** Thomas, J.; Jacobs, P. Lawrence Livermore National Lab., CA (United States). Nov 1994. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950127–6: 11. international conference on ultra-relativistic nucleus-nucleus collisions, Monterey, CA (United States), 9-13 Jan 1995). Order Number DE95012258. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a list of the major heavy ion experiments conducted at CERN and Brookhaven.

22767 (UCRL-ID–119854) **Heavy ion physics at the Brookhaven alternating gradient synchrotron.** Sangster, T.C. Lawrence Livermore National Lab., CA (United States). 30 Jan 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011696. Source: OSTI; NTIS; INIS; GPO Dep.

The collision of large nuclei at relativisitic energies is the only known mechanism for creating and studying the properties (equation-of-state, EOS) of extremely dense nuclear matter. At sufficiently high matter densities, one of the most exciting possibilities is the formation of a Quark Gluon Plasma (QGP). However, it is an extremely difficult task to determine the ultimate density achieved during these collisions due to the fleeting nature of the high density state (the lifetime of these states is typically a few times 10-24 ns). We must rely on detailed comparisons between experimental measurements and complex Monte Carlo simulations of the colliding nuclei in order to extract meaningful estimates of the nuclear matter EOS. Our approach has been to study the behavior of the spectator matter (those protons and neutrons which do not directly interact during the collision) to determine the dynamics of the high density state which must necessarily influence the spectator matter as it decays. This report summarizes some of the key results of our study.

22768 (UCRL-JC–118789) **Experimental status of the AGS Relativistic Heavy Ion Program.** Sangster, T.C. Lawrence Livermore National Lab., CA (United States). Oct 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940722–46: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE95011763. Source: OSTI; NTIS; INIS; GPO Dep.

The universal motivation for colliding large nuclei at relativistic energies is the expectation that a small volume of the primordial quark soup, generally referred to as the Quark-Gluon Plasma (QGP), can be created and studied. The QGP is formed via a phase transition caused by either the extreme baryon densities and/or the extreme temperatures achieved in the overlap zone of the two colliding nuclei. Experiments at the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) using a beam of Si nuclei at 14.6 GeV per nucleon on various nuclear targets have been completed. These same experiments are now actively searching for signatures of QGP formation using a beam of Au nuclei at 11.7 GeV per nucleon. This paper briefly summarizes some of the key results from the Si beam program and the current status of the experimental Au beam program at the AGS.

6635 Nuclear Mass Ranges

Refer also to citation(s) 22677, 22685, 22690, 22693, 22694, 22695, 22697, 22698, 22699, 22701, 22703, 22715, 22716, 22717, 22718, 22719, 22722, 22723, 22724, 22725, 22726, 22727, 22728, 22731, 22734, 22743, 22744, 22747, 22748, 22749, 22751, 22753, 22759, 22762, 22764, 22765

6636 Radiation Physics

Refer also to citation(s) 20953, 21219, 21261, 21877, 22003, 22103, 22793, 22917, 22965

22769 (UCRL-JC–119948) **Impact of atmospheric turbulence on Van Cittert-Zernike speckle cell area estimates.** Morris, J.R. Lawrence Livermore National Lab., CA (United States). 17 Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9503149–1: 2. chemical analysis by laser interrogation of proliferation effluents (CALIOPE) meeting, Albuquerque, NM (United States), 28-30 Mar 1995). Order Number DE95011750. Source: OSTI; NTIS; INIS; GPO Dep.

Simulations of laser beam propagation at 3.5 microns wavelength through atmospheric turbulence are used to characterize on-target irradiance profiles and the Van Cittert-Zernike speckle cell areas associated therewith. Results for a 3 km horizontal path with C_N^2 values between 2.5×10^{-14} and 5×10^{-13} $m^{-2/3}$ are compared with those for a 20 km near-vertical slant path for a C_N^2 versus altitude with a near-ground value of $5 \times 10^{--13} m^{-2/3}$ and a Huffnagel-Valley type shape. The irradiance fluctuations for the slant path are much smaller than for the shorter horizontal path.

The speckle cell area for the slant path is approximately the vacuum-path value; for the 3 km horizontal path it is at most 3 times the vacuum-path value.

22770 (WHC-SD-MP-SWD-30001-Rev.7) **Certification of MCNP Version 4A for WHC computer platforms. Revision 7.** Carter, L.L. Westinghouse Hanford Co., Richland, WA (United States). 3 May 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011546. Source: OSTI; NTIS; INIS; GPO Dep.

MCNP is a general-purpose Monte Carlo code that can be used for neutron, photon, or coupled neutron/photon transport, including the capability to calculate eigenvalues for critical systems. The code treats an arbitrary three-dimensional configuration of materials in geometric cells bounded by first- and second-degree surfaces, and some special fourth-degree surfaces (elliptical tori).

6640 Atomic and Molecular Physics

22771 (LBL–36919) **New results in atomic physics at the Advanced Light Source.** Schlachter, A.S. Lawrence Berkeley Lab., CA (United States). Jan 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-941268–2: 4. U.S./Mexico joint symposium on atomic and molecular physics, San Juan Del Rio (Mexico), 7-10 Dec 1994). Order Number DE95012329. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source is the world's first low-energy third-generation synchrotron radiation source. It has been running reliably and exceeding design specifications since it began operation in October 1993. It is available to a wide community of researchers in many scientific fields, including atomic and molecular science and chemistry. Here, new results in atomic physics at the Advanced Light Source demonstrate the opportunities available in atomic and molecular physics at this synchrotron light source. The unprecedented brightness allows experiments with high flux, high spectral resolution, and nearly 100% linear polarization.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

22772 (LBL–36923) **X-ray Raman scattering in H-BN observed by soft x-ray fluorescence spectroscopy.** Jia, J.J. (Tennessee Univ., Knoxville, TN (United States)); Callcott, T.A.; Carlisle, J.A.; Terminello, L.J.; Asfaw, A.; Ederer, D.L.; Himpsel, F.J.; Perera, R.C.C. Lawrence Berkeley Lab., CA (United States). Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grants DMR-9017996, DMR-9017997. Order Number DE95012360. Source: OSTI; NTIS; GPO Dep.

Raman scattering of soft x-rays is observed in h-BN using monochromatic soft x-rays just below the B K absorption edge. The inelastic features are visible below threshold, track with the excitation energy, go through a resonance as the excitation is tuned to the B ls core exciton energy, and finally evolve into normal fluorescence as the excitation is raised above the energy needed to excite the B ls electron into the conduction band. The inelastic energy loss is identified as an excitation of valence σ electrons into the π^* valence exciton state; at resonance and above, $\pi - \pi^*$ transitions are also observed. At resonance, a sideband on the elastic peak Ls observed, which gives evidence of additional electronic and phonon loss processes. Very similar results have also been observed for B_2O_3.

22773 (UCRL-JC–117697) **Spectral measurements of few-electron uranium ions produced and trapped in a high-energy electron beam ion trap.** Beiersdorfer, P. Lawrence Livermore National Lab., CA (United States). 4 Nov 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941129–26: 13. international conference on the application of accelerators in research and industry, Denton, TX (United States), 7-10 Nov 1994). Order Number DE95014125. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of $2s_{1/2}$-$2p_{3/2}$ electric dipole and $2p_{1/2}$-$2p_{3/2}$ magnetic dipole and electric quadrupole transitions in U^{82+} through U^{89+} have been made with a high-resolution crystal spectrometer that recorded the line radiation from stationary ions produced and trapped in a high-energy electron beam ion trap. From the measurements we infer -39.21 ± 0.23 eV for the QED contribution to the $2s_{1/2}$-$2p_{3/2}$ transition energy of lithiumlike U^{89+}. A comparison between our measurements and various computations illustrates the need for continued improvements in theoretical approaches for calculating the atomic structure of ions with two or more electrons in the L shell.

6643 Collision Phenomena

22774 (BNL–61720) **Inelastic cross sections for positron scattering from atomic hydrogen.** Weber, M. (Bielefeld Univ. (Germany). Fakultaet fuer Physik); Hofmann, A.; Raith, W.; Sperber, W.; Jacobsen, F.; Lynn, K.G. Brookhaven National Lab., Upton, NY (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9405170–10: 10. international conference on positron annihilation, Beijing (China), 23-29 May 1994). Order Number DE95013845. Source: OSTI; NTIS; INIS; GPO Dep.

Positronium formation (Ps) cross sections for positrons impinging on atomic hydrogen were measured in the impact energy range from 13eV to 255eV at the High Intensity Positron (HIP) beam at Brookhaven National Laboratory (BNL). The Ps-formation cross section was found to rise rapidly from the threshold at 6.8eV to a maximum value of $(2.98 \pm 0.18) \times 10^{-16}$ cm^2 for $\approx$ 15eV positrons. By 75eV it drops below the detection limit of 0.17×10^{-16} cm^2 which is the present level of statistical uncertainty. The experiment was modified to enable the measurement of doubly differential scattering cross sections.

22775 (UCRL-JC–112929) **Measurements of cross sections and resonance structures following electron-impact excitation/ionization of Na-like Kr and Xe.** Schneider, D.; Dewitt, D.; Knapp, D.A.; Reed, K.J.; Chen, M.H. Lawrence Livermore National Lab., CA (United States). 28 Sep 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941129–25: 13. international conference on the application of accelerators in research and industry, Denton, TX (United States), 7-10 Nov 1994). Order Number DE95011731. Source: OSTI; NTIS; GPO Dep.

We report high-resolution measurements of electron impact excitation and ionization cross sections for the Na-like ions Kr^{25+} and Xe^{43+}. Ions with ionization states centered on the Na-like configurations were produced in an electron beam ion trap (EBIT) using electrons with energies below the L shell ionization thresholds. The Na-like ions were exposed to an electron beam with an energy between 3 and 7 keV. The Na- and Ne-like ions were then extracted and their intensities measured as a function of the electron beam energy. Theoretical ionization cross sections were calculated using relativistic distorted wave methods. Complex resonance structures that appear in the computed cross sections are observed in the experimental results. These results are the first experimental observation of resonant-excitation-double-autoionization (READA) in highly charged high-Z ions.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 21723, 22775

22776 (LBL–36615) **Transition undulator radiation as bright infrared sources.** Kim, Kwang-Je. Lawrence Berkeley Lab., CA (United States). Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950261–3: Contribution for Halbach Festschrift, Berkeley, CA (United States), 3 Feb 1995). Order Number DE95011276. Source: OSTI; NTIS; INIS; GPO Dep.

Undulator radiation contains, in addition to the usual component with narrow spectral features, a broad-band component in the low frequency region emitted in the near forward direction, peaked at

an angle $1/\gamma$, where γ is the relativistic factor. This component is referred to as the transition undulator radiation, as it is caused by the sudden change in the electron's longitudinal velocity as it enters and leaves the undulator. The characteristics of the transition undulator radiation are analyzed and compared with the infrared radiation from the usual undulator harmonics and from bending magnets.

6645 Special Atoms and Molecules

Refer also to citation(s) 22774

22777 (IC–95/78) **Nonlocal stabilized jellium clusters.** Nafari, N. (International Centre for Theoretical Physics, Trieste (Italy)); Payami, M. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 29p. Order Number DE95634209. Source: OSTI; NTIS (US Sales Only); INIS.

We have used the stabilized spherical jellium model for the simple metal clusters ($2 \leq N \leq 1106$), i.e., Li, Na are K and have solved the Kohn-Sham equations self-consistently. The comparison of the local and nonlocal density approximations shows an appreciable difference between the total cluster-energies per atom for small size clusters. The magnitudes of these local-nonlocal energy differences in the case of the simple spherical jellium model are greater than the deformation energy differences brought about by the application of the ellipsoidal jellium model. The calculated binding energies for the stabilized spherical jellium model, in the limit of large cluster sizes, are close to the value of the bulk experimental binding energy of the corresponding metal. This is to be contrasted with the simple jellium model binding energy which is nearly three times smaller. The ionization potentials remain more or less the same for the local and nonlocal approximations and approach the bulk metal work functions. (author). 37 refs, 7 figs.

22778 (INS–1080) **Phase and density dependence of the delayed annihilation of metastable antiprotonic helium atoms in gas, liquid and solid helium.** Widmann, E. (and others); Sugai, I.; Yamazaki, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1994. 25p. Order Number DE95780501. Source: OSTI; NTIS; INIS.

Systematic studies of the phase and density dependence of the delayed annihilation time spectra of antiprotons (DATS) in gaseous, liquid and solid helium have been performed using the Low Energy Antiproton Ring (LEAR) at CERN. The results show a small but significant dependence of DATS on the phase and density of the helium medium. The average lifetime of antiprotons (T_{av}) in gas at 10-30 K was found to be 4.03 ± 0.02 μs. In liquid helium T_{av} decreases with density from 3.0 μs at 1 bar to 2.5 μs at 60 bar, while in solid helium its value is 2.14 ± 0.03 μs, 20% shorter than that in liquid helium of the same density. There is no change of DATS between normal 1-bar liquid and superfluid helium. An isotope effect between ^{4}He and ^{3}He similar to the one previously observed in the gas phase has also been found for liquid helium. All the data can be fitted fairly well with a simple three-level chain decay model which describes the general structure of DATS, characterized by downward curving behavior on a logarithmic scale at later times and by the presence of a short-lived component. No delayed annihilation was observed in lithium. (author).

22779 (JINR–94-1, pp. 10-11) **Experimental investigation of muonium - antimuonium conversion.** Abazov, V.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Baranov, V.A.; Bragin, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. MUONIUM/conversion; ELECTRON SPECTRA; MUONIUM; CONVERSION; MUONS; PROBABILITY; SILICON OXIDES

22780 (JINR–94-1, pp. 34-35) **Search for muonium-antimuonium conversion (μ^+e^-) -> (μ^-e^+).** Kuchinskij, N.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Karpukhin, V.V.; Kisel', I.V.; Kravchuk, N.P.; Korenchenko, A.S.; Khomutov, N.V.; Baranov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 figs. MUONIUM/conversion; COUPLING CONSTANTS; ELECTRONS; MUONIUM; CONVERSION; MUONS MINUS; MUONS PLUS; POSITRONS

22781 (JINR–94-1, pp. 70-71) **Lifetime measurement of ($\pi^+\pi^-$) atoms to test low energy QCD prediction.** Afanas'ev, L.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Gorchakov, O.E.; Ivanov, M.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993*. 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 2 figs. PIONIC ATOMS/lifetime; GROUND STATES; LIFETIME

22782 (JINR-E–4-94-123, pp. 53) **Observation of atoms consisting of π^+ and π^--mesons.** Afanasyev, I.G. (and others); Shvyrov, A.S.; Gorchakov, O.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts*. Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PIONIC ATOMS/pions minus; PIONIC ATOMS/pions plus; PROTON REACTIONS; TANTALUM

6650 Physics of Condensed Matter

Refer also to citation(s) 21603, 21650, 21658, 22777, 22876, 22918, 22929

22783 (DOE/ER/45278–T2) **Nucleation, propagation, electronic levels and elimination of misfit dislocations in III-V semiconductor interfaces. Final report.** Watson, G.P.; Matragrano, M. Cornell Univ., Ithaca, NY (United States). Mar 1995. 279p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45278. Order Number DE95011595. Source: OSTI; NTIS; GPO Dep.

This report discusses the following topics: strained layer defects; the structural and electronic characteristics of misfit dislocations; requirements for the growth of high quality, low defect density InGaAs strained epitaxial layers; the isolation and nucleation of misfit dislocations in strained epitaxial layers grown on patterned, ion-damaged GaAs; the effect of pattern substrate trench depth on misfit dislocation density; the thermal stability of lattice mismatched InGaAs grown on patterned GaAs; misfit dislocations in ZnSe strained epitaxial layers grown on patterned GaAs; and the measurement of deep level states caused by misfit dislocations in InGaAs/GaAs grown on patterned GaAs substrates.

22784 (IC–95/73) **Asymptotic solution of the non-isothermal Cahn-Hilliard system.** Omel'yanov, G.A. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 27p. Grant 93-011-16560. Order Number DE95634466. Source: OSTI; NTIS (US Sales Only); INIS.

The non-isothermal Cahn-Hillard questions with a small parameter in the n-dimensional case ($n = 2.3$) are considered. The small parameter is proportional both to the relaxation time and to the linear scale of transition zone, so the large time process is examined. The asymptotic solution describing the free interface dynamics is constructed. As the small parameter tends to zero, the limiting solution satisfies the modified Stefan problem with corrected Gibbs-Thomson law. The justification of the asymptotic solution is proved. (author). 26 refs.

22785 (IS-T–1697) **Theory of magneto-optics and circular magnetic x-ray dichroism.** Wang, Xindong. Ames Lab., IA (United States). 20 Oct 1994. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE95010129. Source: OSTI; NTIS; GPO Dep.

This thesis contains three parts. In the first part, before getting into the discussion of magneto-optical properties for the systems

under study, the author reviews some background subjects, such as the energy-band theory within the framework of density functional theory, the multiple scattering approach to the solution of band problem and its relation with the LMTO method, an account of the tight-binding LMTO method which we use exclusively in our calculations, the linear response theory and its application to the quantum theory of dielectric constants. In second part, circular magnetic x-ray dichroism, as a powerful and newly experimental technique for quantitative study of the magnetic properties of materials, is discussed. In the last part, the detailed study of the magneto-optical properties of some transition metals and the so-called half metallic Heusler alloys is presented.

22786 (IS-T–1732) **Measurement and modelling of structure sensitive magnetic properties of material.** Chen, Zhao-Jun. Ames Lab., IA (United States). 10 Feb 1995. 202p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE95010128. Source: OSTI; NTIS; GPO Dep.

Due to the fact that magnetic properties of ferromagnetic materials are highly microstructure sensitive, magnetic non-destructive testing (NDT) techniques for material evaluation have developed very quickly in recent years. This dissertation is mainly focused on the magnetic hysteresis measurement technique. The modelling of structure-sensitive magnetic properties will be discussed first. As a result, the relationship between defect density, the initial permeability and the hysteresis parameter k will be developed. This is followed by the application of magnetic hysteresis measurement techniques in the detection of fatigue damage and creep damage. It will be shown that structure sensitive magnetic properties such as coercivity, remanence, hysteresis loss and initial permeability are very sensitive to material degradation due to fatigue and creep effects. Finally, practical problems in hysteresis measurement will be discussed and techniques to overcome these difficulties will also be presented.

22787 (SAND–95-0775) **Unified model of the rf plasma sheath.** Riley, M.E. Sandia National Labs., Albuquerque, NM (United States). May 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012114. Source: OSTI; NTIS; GPO Dep.

By developing an approximation to the first integral of the Poisson equation, one can obtain solutions for the voltage-current characteristics of a radio-frequency (rf) plasma sheath that are valid over the whole range of inertial response of the ions to an imposed rf voltage or current-specified conditions. The theory adequately reproduces the time-dependent voltage-current characteristics of the two extreme cases corresponding to the Lieberman rf sheath theory and the Metze-Ernie-Oskam theory. Contained within the approximation is a time constant which controls the amount of ion response to the rf electric field. A prescription is given for determining this ion relaxation time constant, which also determines the time-dependent ion impact energy on the electrode surface.

6651 Nuclear Techniques In Condensed Matter Physics

Refer also to citation(s) 21642

22788 (CONF-950865–3) **The secondary characteristic fluorescence correction in the EPMA.** Anderson, I.M. (Oak Ridge National Lab., TN (United States)); Bentley, J.; Carter, C.B. Oak Ridge National Lab., TN (United States); Minnesota Univ., Minneapolis, MN (United States). Dept. of Chemical Engineering and Materials Science. [1995]. 3p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC05-76OR00033 ; AC05-84OR21400. Grant DMR-8901218. From 29. annual meeting of the Microbeam Analysis Society; Breckenridge, CO (United States); 6-11 Aug 1995. Order Number DE95012866. Source: OSTI; NTIS; GPO Dep.

Short communication. ELECTRON MICROPROBE ANALYSIS/ fluorescence; FLUORESCENCE; ELECTRON PROBES

22789 (INIS-RU–405, pp. 405-408) **Electron paramagnetic resonance spectra of lithium-6 deuteride exposed to ultraviolet radiation and gas discharge plasma.** Bunyatova, E.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Bubnov, N.N.; Solodovnikov, S.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Electron paramagnetic resonance spectra of Li^6D exposed to ultraviolet (UV) radiation and gas discharge plasma are investigated. A possibility of F center formation in ^6LiD crystals exposed to UV irradiation and gas discharged is shown. 8 refs.; 2 figs.

22790 (JINR–94-1, pp. 20-21) **The study of the condensed state of matter by μSR (Muon Spin Rotation) technique.** Chaplygin, I.L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Duginov, V.N.; Grebinnik, V.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. MUON SPIN RELAXATION/copper oxides; MUON SPIN RELAXATION/cuprates; MAGNETIC FIELDS; CUPRATES; MUONS; PHASE TRANSFORMATIONS; SPIN ORIENTATION; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE 0013-0065 K; TEMPERATURE RANGE 0065-0273 K

22791 (UCRL-JC–116442-Rev.1) **Linear and circular dichroism in angle resolved Fe 3p photomission. Revision 1.** Tamura, E. (Lawrence Livermore National Lab., CA (United States)); Waddill, G.D.; Tobin, J.G.; Sterne, P.A. Lawrence Livermore National Lab., CA (United States). 7 Dec 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941144–162-Rev.1: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95013274. Source: OSTI; NTIS; INIS; GPO Dep.

Using a recently developed spin-polarized, fully relativistic, multiple scattering approach based on the layer KKR Green function method, we have reproduced the Fe 3p angle-resolved soft x-ray photoemission spectra and analyzed the associated large magnetic dichroism effects for excitation with both linearly and circularly polarized light. Comparison between theory and experiment yields a spin-orbit splitting of 1.0–1.2 eV and an exchange splitting of 0.9–1.0 eV for Fe 3p. These values are 50–100% larger than those hitherto obtained experimentally.

6652 Solid-State Plasma

22792 (IC–95/65) **Memory and threshold switching in thin film PMMA polymer.** Rabah, K.V.O. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 10p. Order Number DE95634553. Source: OSTI; NTIS (US Sales Only); INIS.

Threshold switching between two impedance states have been observed at room temperature in a polymethylmethacrylate (PMMA) thin film sandwiched between two evaporated Al-metal electrodes. The cell's I-V characteristics were found to exhibit memory property. (author). 19 refs, 4 figs.

6653 Interactions Between Beams and Condensed Matter

Refer also to citation(s) 21673, 21674

22793 (ANL/ER/PP–81404) **Stopping power, its meaning, and its general characteristics.** Inokuti, Mitio. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95012463. Source: OSTI; NTIS; INIS; GPO Dep.

This essay presents remarks on the meaning of stopping, power and of its magnitude. More precisely, the first set of remarks concerns the connection of stopping power with elements of particle-transport theory, which describes particle transport and its consequences in full detail, including its stochastic aspects. The second set of remarks concerns the magnitude of the stopping

power of a material and its relation with the material's electronic structure and other properties.

22794 (CONF-9407184–1) **Laser induced diffusion of ion-implanted bismuth in fused silica.** Park, S.Y. (Vanderbilt Univ., Nashville, TN (United States). Materials Science and Engineering); Weeks, R.A.; Zuhr, R.A. Oak Ridge National Lab., TN (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. international Otto Schott colloquium; Jena (Germany); 11-14 Jul 1994. Order Number DE95012869. Source: OSTI; NTIS; GPO Dep.

The near surface regions of optical grade fused silica discs (Spectrosil A) were modified by implantation with bismuth ions at 160 and 320 keV and at room temperature. The glasses implanted with a nominal dose of 6×10^{16} Bi^{2+} ions/cm^2 were subsequently annealed with a 5 eV KrF pulsed excimer laser and by a furnace in oxygen atmosphere. Rutherford backscattering and optical absorption were measured before and after the anneals. Backscattering profiles after laser anneal showed shifts of the profiles toward the surface with decrease in retained dose. We attribute the diffusion of bismuth to Soret effect. Profiles of furnace annealed samples showed that the diffusion was both toward and away from the surface.

22795 (FZR–77) **Forschungszentrum Rossendorf, Institut fuer Ionenstrahlphysik und Materialforschung. Annual report 1994.** Moeller, W. (ed.); Wieser, E. (ed.); Kirch, S. (ed.). Forschungszentrum Rossendorf e.V. (FZR) (Germany). Inst. fuer Ionenstrahlphysik und Materialforschung. Mar 1995. 110p. Order Number DE95785380. Source: OSTI; NTIS (US Sales Only); INIS.

This volume contains the 1994 annual report describing the scientific activity of the Institute of Ion Beam Physics and Material Research (Forschungszentrum Rossendorf, FZR). This institute is devoted to the application of ion beams for the modification and analysis of near-surface layers of solids. (MSA)

22796 (INIS-RU–405, pp. 303-326) **Preliminary results on the first observation of channeled sigma-hyperon spin precession in bent crystals.** Baublis, V.V. (and others). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

Preliminary results of first observations spin precession in silicon bent crystals are presented. Measurements of the magnetic moments of sigma hyperons are made. 3 refs.

22797 (INIS-RU–405, pp. 311-316) **Polarization γ-quants spectrum after π^0-meson decay and channeling in oriented tungsten monocrystals.** Potylitsyn, A.P.; Radutskij, G.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

The values of photon beam divergence and angular beam acceptance of oriented ideal tungsten monocrystals are compared with a view of estimating the prospects of the suggested method of polarized photon beam production on TeV-accelerators during $\pi^0(\eta)$-mesonic decay. The yield of decay photons does not exceed the value of 10^{-4} ph/d. 7 refs.

22798 (INIS-RU–405, pp. 447-450) **Computerized simulation of spin rotation effect of relativistic particles by a bent crystal.** Krivosheev, O.Eh.; Pivovarov, Yu.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. 460p. (In Russian). (CONF-9109331–: 4. workshop on high energy spin physics, Protvino (USSR), 3 Sep 1991). In *IV. Workshop on High Energy Spin Physics.* Order Number DE95632424. Source: OSTI; NTIS (US Sales Only); INIS.

A multi string model is offered to calculate the spin rotation effect of relativistic particles in a bent crystal. Electron scattering is simulated with respect to Gauss distribution. 6 refs. 3 figs.

22799 (LBL–35963) **Surface charge control during high-current ion implantation: Characterization with CHARM-2 sensors.** Current, M.I. (Applied Materials, Santa Clara, CA (United States). Implant Div.); Lukaszek, W.; Vella, M.C.; Tripsas, N.H. Lawrence Berkeley Lab., CA (United States). Jun 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9406267–2: IIT '94 conference, Catania (Italy), 13-17 Jun 1994). Order Number DE95011278. Source: OSTI; NTIS; INIS; GPO Dep.

Studies of the charging effects during implantation with 9200 and 9500 tools using EEPROM-based sensors, CHARM-2, are reported for 60keV As beams.

6654 Quantum Physics Aspects of Condensed Matter

22800 (IC–95/53) **Integrable Chern-Simons gauge field theory in 2 + 1 dimensions.** Pashaev, O.K. International Centre for Theoretical Physics, Trieste (Italy). Apr 1995. 16p. Order Number DE95634579. Source: OSTI; NTIS (US Sales Only); INIS.

The classical spin model in planar condensed media is represented as the U(1) Chern-Simons gauge field theory. When the vorticity of the continuous flow of the media coincides with the statistical magnetic field, which is necessary for the model's integrability, the theory admits zero curvature connection. This allows me to formulate the model in terms of gauge -invariant fields whose evolution is described by the Davey-Stewartson (DS) equations. The Self-dual Chern-Simons solitons described by the Liouville equation are subjected to corresponding integrable dynamics. As a by-product the 2 + 1-dimensional zero-curvature representation for the DS equation is obtained as well as the new reduction conditions related to the DS-I case. Some possible applications for the statistical transmutation in the anyon superfluid and TQFT are briefly discussed. (author). 21 refs.

22801 (IC–95/75) **Global Bethe lattice consideration of the spin-1 Ising model.** Akheyan, A.Z.; Ananikian, N.S. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 24p. Grant 211-5291YPI; INTAS-93-633. Order Number DE95634580. Source: OSTI; NTIS (US Sales Only); INIS.

The spin-1 Ising model on the Bethe lattice with bilinear, biquadratic exchange interactions and a single-ion crystal field by means of recursion relations is solved exactly. A full set of phase diagrams for positive and negative biquadratic couplings are constructed. A general procedure for the investigation of the critical properties is discussed. A comparison with other approximation schemes is done. (author). 24 refs, 4 figs.

22802 (IC–95/92) **Quantum critical phenomena and conformal invariance.** Zhe Chang. International Centre for Theoretical Physics, Trieste (Italy). May 1995. 18p. Order Number DE95634581. Source: OSTI; NTIS (US Sales Only); INIS.

We show that the Abelian bosonization of continuum limit of the 1D Hubbard model corresponds to the 2D explicitly conformal invariant Gaussian model at weak coupling limit. A universality argument is used to extend the equivalence to an entire segment of the critical line of the strongly correlated electron system. An integral equation satisfied by the mapping function between critical lines of the 1D Hubbard model and 2D Gaussian model is obtained and then solved in some limiting cases. By making use of the fact that the free Hubbard system reduces to four fermions and each of them is related to a c = 1/2 conformal field theory, we present exactly the partition function of the Hubbard model on a finite 1D lattice. (author). 16 refs.

22803 (LA-UR–94-1148, pp. 3-24) **Are Kondo insulators simply insulators?.** Aeppli, G. (AT&T Bell Laboratories, Murray Hill, NJ (United States)); DiTusa, J.F.; Fisk, Z. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials:*

The Los Alamos symposium 1993. 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Since the discovery of the anomalous normal state properties of the high-T_c oxides, there has been a lively debate concerning the applicability of conventional Fermi liquid theory to strongly interacting metals. A question arising naturally in this context is whether strongly interacting insulators exhibit properties at odds with ordinary band theory. Of course, Mott insulators, which in the absence of strong Coulomb interactions would be metals, represent the most dramatic breakdown of band theory. However, among strongly interacting insulators which one believes are band insulators, there have until recently been no indications that many-body effects yield observable consequences beyond those which band parameter renormalization might account for. The large number of recent theoretical papers on this renormalization for f-band materials, as well as the long struggle to achieve quantitative understanding of the band gap in as basic a semiconductor as Si, attest to the importance and difficulty of calculating renormalized band parameters for insulators. Also, the experience with Si clearly shows that the renormalization can depend on the quantity being measured. In a recent review, the authors placed the newly discovered Ce-based Kondo insulators, as well as older anomalous semiconductors such as SmB_6 and FeSi, in the context of renormalized band theory. The conclusion was that in large measure, this theory represents an adequate starting point for understanding strongly correlated insulators. The goal here is not to repeat what was said before, but to focus on those aspects of charge and spin fluctuations which the band picture cannot obviously accomodate.

22804 (LA-UR–94-1148, pp. 36-40) **Magnetotransport measurements in magnetic fields up to 50T in SmB_6 and FeSi.** Lacerda, A. (Los Alamos National Laboratory, NM (United States)); Graf, T.; Sarrao, J.L.; Mandrus, D.; Hundley, M.F.; Thompson, J.D.; Fisk, Z.; Van Bockstal, L. Los Alamos National Lab., NM (United States). [1994]. Agreement DMR-9016241. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors have measured the transverse magnetoresistance ($B \perp I$) in high-quality single-crystalline samples of SmB_6 and FeSi at 4K in applied magnetic fields to 50T and in the temperature range $4K < T < 150K$ in magnetic fields to 18T. The magnetoresistance in SmB_6 at 4K decreases quadratically and reaches about −45% at 50T. The compound FeSi reveals three distinct features in the magnetoresistance: (a) a negative magnetoresistance for fields below 5T, (ii) a kink at around 10T, and (iii) a broad maximum near 30T.

22805 (LA-UR–94-1148, pp. 41-45) **Magnetic excitations in Kondo insulators.** Wang, Z. (Los Alamos National Laboratory, NM (United States)); Lee, D.H. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors perform analytical and numerical analysis for the spin dynamics in Kondo insulators. Recently a class of heavy-fermion insulator (known as the 'Kondo insulator') found among stoichiometric rare earth actinide compounds has attracted much experimental and theoretical interest. In many respects, these insulating materials are similar to the more weakly-correlated band-insulators, except that the insulating gap is orders of magnitude smaller than that in conventional band-insulators. In a recent paper the present authors described a class of variational wavefunctions in which the Kondo insulators are viewed as the band-insulating state of the heavy quasiparticles.

22806 (LA-UR–94-1148, pp. 46-49) **On the temperature dependence of the optical spectral weight in correlated electron systems.** Millis, A.J. (AT&T Bell Laboratories, Murray Hill, NJ (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

A temperature dependence of the low frequency optical spectral weight has recently been observed in several strongly correlated insulating or nearly insulating systems including FeSi, $Ce_3Bi_4Pt_3$ and V_2O_{3-y}, and Bi_2Te_3. This temperature dependence is at first sight surprising because one is accustomed to thinking of optical spectral weigth in terms of the f-sum rule, which in its most general form states that the integral of any of the diagonal components of the optical conductivity $\sigma_1(\omega)$ is $\pi ne^2/2m$. This is not very useful in most condensed matter physics contexts because the quantity n is the total number of electrons, including e.g. those in core levels, and because one must extend the integral to energies greater than the binding energy of the 1s shell to exhaust the sum rule. In condensed matter problems one typically focuses on a small number of bands close to the chemical potential. One may then ask what is the restricted sum rule governing optical transitions involving only these bands. Of course, the answer to this question is useful only if optical transitions involving bands retained in the model can be separated from those involving bands not retained.

22807 (LA-UR–94-1148, pp. 50-53) **Fermi surface instability at 0.4K in a heavy-fermion YbBiPt: SDW?.** Movshovich, R. (Los Alamos National Laboratory, NM (United States)); Lacerda, A.; Canfield, P.C.; Thompson, J.D.; Fisk, Z. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors report results of resistivity measurements of heavy-fermion compound YbBiPt at ambient and hydrostatic pressures of up to ≈6kbars and in magnetic fields up to 1 Tesla. They interpret the rise of resistivity below 0.4K as partial gapping of the Fermi surface. From the temperature dependence of the resistivity they obtain the value of the weak coupling energy gap of $\Delta_0/k_BT_c = 1.65 \pm 0.15$. Magnetic field - transition temperature phase diagram follows the weak coupling BCS expression remarkably well from T_c to $T_c/4$. These results support identification of 0.4K transition as a Spin Density Wave formation.

22808 (LA-UR–94-1148, pp. 96-100) **Influence of magnetic order on optical properties of the heavy-electron antiferromagnets.** Degiorgi, L. (Laboratorium fuer Festkoerperphysik, Zuerich (Switzerland)); Ott, H.R.; Gruener, G.; Dressel, M.; Fisk, Z. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors discuss the influence of antiferromagnetic order on optical properties of several heavy-electron systems. They find different electrodynamic responses of local magnetic moment and itinerant heavy-electron antiferromagnets. The electrodynamics of several heavy-electron metals have been explored in detail. However, significantly less is known about the electrodynamics of the magnetically-ordered states of these materials. Some prototype compounds, where antiferromagnetic order develops, are URu_2Si_2, UPd_2Al_3, U_2Zn_{17}, and UCu_5. The so called antiferromagnetic state can develop as the consequence of a Fermi-surface instability, and such spin density wave formation leads to a gap (or partial gap) $2\Delta = 3.52k_BT_N$ at the Fermi level. A commensurate antiferromagnetic order, on the other hand, does not lead to a gap at the Fermi level for a partially filled band. The first case is called an itinerant, and the second a local moment antiferromagnet. While magnetic properties such as the magnetic susceptibility may be similar in both cases, optical conductivity measurements may discriminate between the different types of antiferromagnetic order.

22809 (LA-UR–94-1148, pp. 101-105) **4f heavy femion photoelectron spectra do not exhibit the Kondo scale.** Arko, A.J. (Los Alamos National Laboratory, NM (United States)); Joyce, J.J.; Andrews, A.B.; Blyth, I.R.; Barlett, R.J.; Fisk, Z.; Canfield, P.C.; Olson, C.G.; Benning, P.J.; Poirier, D.M.; Weaver, J.H.; Riseborough, P.S. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM

(United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

It has been the authors contention for some time that the Single Impurity Anderson Model (SIAM), as extended by Gunnarsson and Schonhammer (GS), or the non-crossing approximation (NCA), does not correctly describe the 4f photoelectron spectra of heavy fermions. Recently they have concentrated on Yb heavy fermions since in these materials the Kondo resonance (KR) is fully occupied and thus accessible via photoemission. In particular, they have repeatedly pointed out that the width, position, spectral weight, lineshape, and temperature dependence of the features assumed to be the KR and its sidebands, are nearly independent of the Kondo temperature, T_K, while at the same time bearing a striking resemblance to the simple 4f core level spectra of pure Yb metal, or of Lu isostructural Lu compounds. It is important to resolve these issues in view of the fundamental nature of the problem.

22810 (LA-UR–94-1148, pp. 131-170) **The mean field theory of the Mott Hubbard transition.** Kotliar, G. (Rutgers Univ., Piscataway, NJ (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DMR 92-42000. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The author describes the mean field theory of strongly correlated electrons which becomes exact in the limit of large lattice coordination and applies it to the Mott transition in the Hubbard model. He compares the predictions of the mean field theory with earlier approaches and with experiments on three dimensional transition metal oxides, and outlines possible extensions of the approach.

22811 (LA-UR–94-1148, pp. 177-222) **The metal-insulator transition in one dimension.** Schultz, H.J. (Universite Paris, Orsay (France)). Los Alamos National Lab., NM (United States). [1994]. Contract CII/0568. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The low-energy excited states of a system of interacting one-dimensional fermions in a conducting state are collective charge and spin density oscillations. The unusual physical properties of such a system (called 'Luttinger liquid') are characterized by the velocities u_ρ and u_σ of the charge and spin excitations, as well as by a parameter K_ρ that determines the power law behavior of correlation functions. Umklapp scattering occurring at half-filling or other commensurate band-filling can lead to a transition into an insulating state, characterized in particular by a gap in the charge excitations (the Mott-Hubbard gap). The properties in the vicinity of the transition are shown to depend on both the way the transition is approached (constant bandfilling and varying interaction, or constant interaction and varying bandfilling) and on the 'order' of the commensurability. In particular, even and odd fractional fillings show quite different behavior. This behavior is illustrated in detail using lattice models like the Hubbard model and its extensions.

22812 (LA-UR–94-1148, pp. 224-228) **Metal insulator transition in strongly correlated electron systems.** Gulacsi, M. (Los Alamos National Laboratory, NM (United States)); Bedell, K.S. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

For the one-dimensional Hubbard model the authors extended the bosonization technique, away from half filling, in such a way that a general formula is obtained for the zero temperature equal-time single-particle Green function with validity over the whole doping range. With their method they can describe exactly the metal-insulator transition at half filling.

22813 (LA-UR–94-1148, pp. 229-233) **Bosonization in two dimensions - application to strongly correlated electrons.** Schmeltzer, D. (City Univ. of New York, NY (United States)); Bishop, A. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Using the space time curve representation, a Bosonization scheme which includes density excitations around each point on the Fermi surface (F.S.) and space time tunneling of charges which belong to different F.S. Points. The space time tunneling reproduces the two dimensional Jordan-Wigner transformation in two dimensions. Using this formalism a spinless fermion model with short range repulsion interaction is investigated. The authors find two parts: sound wave excitations in the normal direction of the F.S. reproduces the Fermi Liquid (F.L.). The second part corresponds to the Cooperon channel, violates charge conservation and gives rise to two particle coherent tunneling. As a results the F.L. phase is destroyed at $T = 0$ and a tunneling gap for charge 2e is formed. They apply their formalism to the t-J model and find that due to the presence of the holon condensate a F.L. phase is obtained. If at $T \neq 0$ the holon condensate disappears, due to thermal vortices a singular propagator for the U(1) gauge field appears giving rise to a non-Fermi liquid (N.F.L.) behavior. The N.F.L. can be understood as a quantum critical behavior with a dynamic exponent $z = 3$.

22814 (LA-UR–94-1148, pp. 234-238) **Phase diagram of two-dimensional quantum antiferromagnets: The J_1-J_2-J_3 model.** Ferrer, J. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

An overview of the phase diagram of the frustrated Quantum Antiferromagnet in two dimensions is given. Special emphasis is made on the nature of the ground states and phases transitions occurring to the classical boundary between the Neel and Spiral states. Most of the work performed on 2+1 dimensional magnetism has focused on the possible ways to destabilize the Neel phase and the nature of the resulting ground state and excitations. This can be achieved by introducing either static or dynamic frustration. This paper will give an overview of the phase diagram of the Quantum Antiferromagnet on a square lattice, where static antiferromagnetic frustration is added to second and third nearest neighbours (given by the coupling constants J_2 and J_3 respectively). Initial studies of this model using a variety of techniques gave rise to different and contradictory results for its ground state close to the classical phase boundary of the Neel phase. This boundary will be termed hereafter as the Classical Critical Line and is given by the equation $J_1 - 2$, $J_2 - 4$, $J_3 = 0$. Some time later, it was found that most of these techniques would give essentially the same results, when used with some care. The phase diagram which emerged finally did not coincide with any of the initial ones, but had features from all of them.

22815 (LA-UR–94-1148, pp. 241-268) **Experimental results on the nature of the superconducting-insulating transition in two dimensions.** Hebard, A.F. (AT&T Bell Laboratories, Murray Hill, NJ (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Experiments probing the competition between superconductivity and disorder in two-dimensional thin-film systems, although not completely understood, have given fascinating glimpses of subtle and unexpected quantum processes and associated phase transitions. There is a general consensus that a superconducting-insulating transition does occur, although there is some disagreement on details. Much of this disagreement arises from the wide disparity in the physical characteristics of the thin-film systems that have been studied and the number of ways in which parameters can be varied to experimentally traverse the boundary between the superconducting and insulating phases. In this paper,

salient experimental results pertaining to the superconducting-insulating transition will be summarized and placed into context with respect to available theoretical prescriptions. Close attention will be paid to the evidence for a boson-dominated transition in which fluctuations in the phase rather than the magnitude of the superconducting order parameter dominate.

22816 (LA-UR–94-1148, pp. 275-304) **The superconducting-insulating phase transition in disordered systems.** Zimanyl, G.T. (Univ. of California, Davis, CA (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DRM 92-06032. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The superconductor-insulator transition is considered in the framework of a bosonic description. The scaling theory of the transition is outlined. Several particular cases are discussed: the ordered situation with short and long range interactions; Josephson junction arrays; the same systems in the presence of disorder; and the transition in a magnetic field.

22817 (LA-UR–94-1148, pp. 310-313) **Metal insulator transition in strongly correlated electron systems.** Monien, H. (Univ. of California, Davis, CA (United States)); Freericks, J.K. Los Alamos National Lab., NM (United States). [1994]. Grant PHY89-04035; Grant DMR90-02492. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Strongly interacting quantum systems exhibit some of the most interesting phenomena in condensed matter physics. Until very recently the study of these systems has been confined to either numerical simulations of rather small systems (which still have an enormous number of quantum states) or approximate analytical methods which are uncontrolled. Most of the effort concentrated on the fermionic systems. In the last few years the bosonic systems have attracted a lot of interest. Examples of the bosonic strongly correlated systems include short coherence length superconductors, Josephson junction arrays, the dynamics of flux lines in high temperature superconductors and the quantum hall effect. The essential physics of all of these problems is the competition between the hopping matrix elements and the short range strong repulsion.

22818 (LA-UR–94-1148, pp. 659-662) **Properties of an orbital Kondo array.** Emery, V.J. (Brookhaven National Laboratory, Upton, NY (United States)); Kivelson, S.A. Los Alamos National Lab., NM (United States). [1994]. DOE Contract AC02-76CH00016. Grant DMR-90-11803. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors consider a solvable model of a one dimensional electron gas interacting with an array of dynamical scattering centers, whose state is specified by a pseudospin variable. In the dilute limit, for frequencies ω and temperatures T below the single-center Kondo scale but above a coherence scale Δ, the physics is governed by the fixed point of the single-impurity two-channel Kondo problem. In that region, the physical properties are governed by composite (or odd-frequency) pairing fluctuations and they are reminiscent of the normal state of high temperature superconductors. As ω and $T \rightarrow 0$, three susceptibilities are equally divergent: (1) conventional, spin-singlet even-parity pairing (2) composite spin-singlet odd-parity η-pairing and (3) odd parity pseudospin.

665410 Superconductivity

Refer also to citation(s) 21326, 21611, 21645, 21982, 21983, 21984, 21986, 22009, 22019, 22022, 22029, 22033, 22034, 22035, 22037, 22047, 22050, 22098, 22107, 22108, 22790, 22877

22819 (ANL/ET/CP–86117) **Applications of bulk high-temperature superconductors.** Hull, J.R. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950637–3: International workshop on superconductivity: controlled processing of high temperature superconductors - fundamentals and applications, Maui, HI (United States), 18-21 Jun 1995). Order Number DE95013519. Source: OSTI; NTIS; GPO Dep.

The development of high-temperature superconductors (HTSs) can be broadly generalized into thin-film electronics, wire applications, and bulk applications. We consider bulk HTSs to include sintered or crystallized forms that do not take the geometry of filaments or tapes, and we discuss major applications for these materials. For the most part applications may be realized with the HTSs cooled to 77 K, and the properties of the bulk HTSs are often already sufficient for commercial use. A non-exhaustive list of applications for bulk HTSs includes trapped field magnets, hysteresis motors, magnetic shielding, current leads, and magnetic bearings. These applications are briefly discussed in this paper.

22820 (ANL/MSD/CP–85925) **The interaction of vortices with twin boundaries.** Crabtree, G.W.; Kwok, W.K.; Welp, U.; Fendrich, J.; van der Beek, C.J.; Vlasko-Vlasov, V.K.; Nikitenko, V.I.; Gunter, D.; Gardiner, T. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31-109-ENG-38. DMR91-20000. (CONF-950292–1: NRIM international seminar on superconductors in high magnetic fields, Tsukuba (Japan), 17-18 Feb 1995). Order Number DE95012079. Source: OSTI; NTIS; GPO Dep.

Twin boundaries provide a convenient defect for investigating vortex dynamics in superconductors. They occur naturally in $YBa_2Cu_3O_7$, with well defined planar geometries. They are a strong pinning defect, and at the temperature of the melting transition they are the dominant pinning sites in clean crystals. Twin boundaries are easily seen in polarized light, making their location and number directly observable without special equipment. Finally, they present a highly anisotropic pinning potential to the vortices, creating the possibility of interesting new behavior. In this paper, we describe experiments using twin boundaries to probe two effects in vortex dynamics: a new peak effect in the critical current occurring in the solid state just below the melting transition, and anisotropic pinning by planar defects.

22821 (CEA-CONF–11888) **High Tc superconductivity with polarons and bipolarons an approach from the insulating states.** Aubry, S. Laboratoire Leon Brillouin (LLB) - Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). 1994. 36p. (CONF-9404139–: Workshop on polarons and bipolarons in high Tc superconductors, Cambridge (United Kingdom), 7-9 Apr 1994). Order Number DE95632116. Source: OSTI; NTIS (US Sales Only); INIS.

After a review of the Holstein-Hubbard model, an approach for understanding bipolaronic superconductivity is proposed, which consists in discussing under which conditions the role of the quantum lattice fluctuations could increase sufficiently in order to favour a bipolaronic superfluid state instead of insulating bipolaronic or polaronic structures and reach perhaps an unusually large high Tc. For that purpose, situations where the direct electron-electron interaction competing with the electron phonon coupling, can break the standard bipolarons into polarons, are studied. If certain quantum fluctuations could become large enough, high Tc superconductivity could take place on the spin-Peierls state; it would be specifically the consequence of a sharply balanced competition between a strong electron-phonon coupling and a strong electron-electron repulsion. 9 figs., 31 refs.

22822 (LA-UR–94-1148, pp. 57-91) **Magnetism and superconductivity in heavy-electron metals.** Ott, H.R. (Laboratorium fuer Festkoerperphysik, Zuerich (Switzerland)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

All the data and features of properties of heavy-electron systems mentioned in this presentation represent only a fraction of recent results obtained in this field. Nevertheless they should demonstrate

that interesting physics may be explored in studies of these materials. Most results that are obtained are important with regard to the understanding of metals in general. These substances are suited for studies of all aspects of many-body effects among conduction electrons in metals and are an important link to quantum fluids or solids like ^{3}He. The quite well established occurrence of unconventional superconductivity is among the most prominent features of heavy-electron physics and, also here, provides a merging of interest with another hot topic of condensed-matter physics, the phenomenon of superconductivity in oxides at relatively high temperatures and in organic substances. As a final comment the author recalls the importance of the materials-science aspects in these problems. The demonstrated strong influence of small amounts of impurities or imperfections on the physical properties of these substances certainly deserves further attention in future experimental and theoretical work.

22823 (LA-UR–94-1148, pp. 106-132) **Fermi-liquid theory for unconventional superconductors.** Sauls, J.A. (Northwestern Univ., Evanston, IL (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Fermi liquid theory is used to generate the Ginzburg-Landau free energy functionals for unconventional superconductors belonging to various representations. The parameters defining the GL functional depend on Fermi surface anisotropy, impurity scattering and the symmetry class of the pairing interaction. As applications the author considers the basic models for the multiple superconducting phases of UPt_3. An important prediction of the leading order Fermi liquid theory for the two-dimensional representations of the hexagonal symmetry group is that the zero-field equilibrium state exhibits spontaneously broken time-reversal symmetry.

22824 (LA-UR–94-1148, pp. 317-349) **Experimental evidence for lattice effects in high-temperature superconductors.** Billinge, S.J.L. (Los Alamos National Laboratory, NM (United States)); Kwei, G.H.; Thompson, J.D. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors present an overview of the experimental evidence for a role of the lattice in the mechanism of high-temperature superconductivity. It appears unlikely that a solely conventional electron-phonon interaction produces the pairing. However, there is ample evidence of strong electron and spin to lattice coupling and observations of a response of the lattice to the electronic state. They draw attention to the importance of the local structure in discussions of lattice effects in high-T_c superconductivity.

22825 (LA-UR–94-1148, pp. 354-358) **Evidence for symmetry breaking local distortions in $Tl_2Ba_2NuO_6$.** Nickel, J.H. (Los Alamos National Laboratory, NM (United States)); Allen, P.G.; Li, Guonguang; Mustre de Leon, J.; Raistrick, I.D.; Conradson, S.D. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

High temperature superconductors (HTSC) are perhaps the most extensively characterized materials of recent times. The average crystallographic structures have been determined by X-ray, neutron and electron diffraction techniques. Recent investigations using extended x-ray absorption fine structures (EXAFS) and pair distribution analysis (PDF), however, have shown that there are significant local deviations from the average crystallographic structure. These local structural anomalies have been observed in several systems, including $YBa_2Cu_3O_7$, $Nd_{2-x}Ce_xCuO_{4-y}$, $Bi_2Ca_2SrCu_2O_8$, and $TlBa_2Ca_3Cu_4O_{11}$. Comparison of the x-ray absorption near edge spectra (XANES) of several superconducting systems indicate that structural anomalies also exist in $Tl_2Ba_2CuO_6$ (2201), and these anomalies reduce the crystal symmetry. The authors interpret this lowering of symmetry as an indication of the existence of localized states in this structure. Powder EXAFS experiments on the Tl based superconductors, as well as preliminary EXAFS results on oriented samples support this conclusion.

22826 (LA-UR–94-1148, pp. 359-363) **Site-selective oxygen isotope shift in $YBa_2Cu_3O_7$.** Nickel, J.H. (Los Alamos National Laboratory, NM (United States)); Morris, D.E.; Ager, J.W. III. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

$YBa_2Cu_3O_7$(123) has four inequivalent oxygen sites: the CuO chain sites [O1], the edge sharing apical sites [O4] and the CuO_2 plane sites [O2,O3]. In all previous isotope shift experiments, isotopic substition was nearly complete and uniform among the different oxygen sites. The measured oxygen isotope shift is ΔT_c = 0.2K for uniform ^{18}O occupation. These studies could not distinguish the contributions of the different oxygen sites to the oxygen isotope effect. The authors have measured the site selective oxygen isotope shift (SS-OIS) of 123 samples containing ~ 95% ^{18}O in the CuO_2 plane sites and primarily ^{16}O in the apical and chain sites.

22827 (LA-UR–94-1148, pp. 364-397) **Lattice and multi-band electronic effects in high-temperature superconductors.** Bishop, A.R. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The large body of evidence for lattice anomalies and complex Fermi surface structures in layered high-temperature cuprate superconductors is briefly reviewed. Theoretical implications are discussed, focusing on: (i) Polaron tunneling as a non-linear, nonadiabatic model for multi-bondlength Cu-O distributions and associated optical and inelastic neutron scattering properties; (ii) Stoichiometric and doping states of a 3-band extended Peierls-Hubbard model for Cu-O planes; and (iii) Weak-coupling analysis of multigap-coupling arising from interband scattering in addition to conventional intraband scattering.

22828 (LA-UR–94-1148, pp. 405-409) **Effect of finite quasiparticle lifetime on the frequency dependence of phonon lifetimes in $d_{x^2-y^2}$ superconductors.** Coffey, D. (State Univ. of New York, Buffalo, NY (United States)); Coffey, L. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The frequency dependence of phonon lifetimes in a superconductor with a $d_{x^2-y^2}$ order parameter is investigated. The authors show that the inclusion of a finite quasiparticle lifetime due to impurity scattering and spontaneous quasiparticle decay smears features, recently proposed as signatures of d-wave superconductivity in cuprate superconductors. They show also that the tight-binding bandstructure leads to features at high frequencies associated with superconductivity. These features may serve as a new probe of the shape of the Fermi surface in cuprate superconductors.

22829 (LA-UR–94-1148, pp. 410-413) **Mott-induced structural transition in 2D metals electrons in the overdoped limit.** Rodriguez, J.P. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

It is well-known now that the conduction electrons in the Copper-Oxygen planes common to all high-temperature superconductors experience strong repulsive interactions. The simplest theoretical

description of this physics for electron densities approaching the antiferromagnetic Mott transition is given by the t-J model on the square-lattice, where double occupancy of electrons at each site is strictly excluded. This constraint may be imposed by the introduction of an auxiliary slave-boson field, b_i, such that the electron field is re-expressed as $c_{i\sigma} \rightarrow c_{i\sigma}b_i^\dagger$, along with the constraint $c_{i\sigma}^\dagger c_{i\sigma} + b_i^\dagger b_i = 1$ at each site. Certain mean-field treatments of the latter constraint allowing the slave-boson to propagate result in a spin-charge separated description of the t-J model in terms of a spinon field, $c_{i\sigma}$, and a holon field, b_i. A statistical gauge field, A_μ, generated by the internal gauge symmetry $(c_{i\sigma},b_i) \rightarrow (e^{i\theta_i}c_{i\sigma}, e^{i\theta_i}b_i)$ then mediates interactions between the two species. In particular, holon scattering off of gapless transverse gauge-field excitations results ultimately in a linear-in-T prediction for resistivity in the fluxless ("strange") metallic phase of the t-J model, which is a feature that is consistently observed in the normal phase of the oxide superconductors.

22830 (LA-UR–94-1148, pp. 417-469) **Experimental evidence for spin fluctuations in high temperature superconductors.** Slichter, C.P. (Univ. of Illinois, Urbana, IL (United States)). Los Alamos National Lab., NM (United States). [1994]. DOE Contract FG02-91ER45439. Grant DMR-88-09854. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

This paper was commissioned to provide background for a discussion session on issues raised by magnetic resonance studies of high temperature superconductors. It is intended to give a succinct summary and as clear an explanation as possible for the conference participants within prescribed page limitations. As a result, the author has not been able to describe all the important papers, or to give a thorough explanation of the contributions of the many scientists whose work was crucial in developing the concepts which it is important for the conferees to grasp. References are presented to give the reader an additional source to consult for a deeper discussion, or to select representative data to demonstrate a point. Many papers are omitted which would be needed were this paper intended as a history of developments.

22831 (LA-UR–94-1148, pp. 476-479) **A nearly antiferromagnetic Fermi liquid description of magnetic scaling and spin gap behavior in the cuprate superconductors.** Pines, D. (Department of Physics and Science and Technology Center for Superconductivity, Urbana, IL (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DMR 91-20000; Grant PHY 89-04035. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The author describes briefly work-in progress with Philippe Monthoux on a Fermi liquid approach to magnetic scaling and spin gap behavior in the cuprate superconductors. The starting point is a generalized mean-field (RPA) description of the dynamic susceptibility, $\chi(q,\omega) = \tilde{\chi}(q,\omega)/(1 - f^{\alpha}_{q}(\omega)\tilde{\chi}(q,\omega))$, $\tilde{\chi}(q,\omega)$ is the irreducible particle-hole susceptibility and $f^{\alpha}_{q}(\omega)$ is a wavevector and frequency dependent mean field vertex correction.

22832 (LA-UR–94-1148, pp. 480-483) **What is the origin of ω/T scaling in the cuprate superconductors?.** Sokol, A. (Univ. of Illinois, Urbana, IL (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Quantum critical antiferromagnetic behavior is a candidate scenario for ω/T scaling of the q-integrated spin susceptibility in the underdoped high-T_c materials, which provides an explanation for the spin gap phenomenon and yields correct quantitative predictions for the nuclear relaxation and neutron scattering. It is likely that understanding the anomaolou normal state properties of the cuprate superconductors will allow one to gain insight into the origin of high temperature superconductivity.

22833 (LA-UR–94-1148, pp. 484-514) **Spin fluctuations and high temperature superconductors.** Rice, T.M. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The author reviews the phenomenological theory based on the nearly antiferromagnetic Fermi liquid ansatz and argues that the underlying assumption of almost criticality requires a strongly correlated microscopic model. With this in mind he then reviews the spin response properties of the t-J model. Lastly a discussion of the effect of breaking up the infinite planes into segments of ladders or clusters will give some new insights into open questions such as the origin of the spin gap and the role of quantum frustration of the magnetic order.

22834 (LA-UR–94-1148, pp. 530-534) **About superconductivity in electronic models for the high-T_c cuprates.** Dagotto, E. (Florida State Univ., Tallahassee, FL (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant ONR N00014-93-1-0495. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Some recent numerical results in the context of the two dimensional Hubbard and t-J models are briefly (and informally) summarized. Superconductivity in these models is discussed.

22835 (LA-UR–94-1148, pp. 535-540) **Spin and pairing correlations in a two-chain Hubbard model.** Noack, R.M. (Univ. of California, Irvine, CA (United States)); White, S.R.; Scalapino, D.J. Los Alamos National Lab., NM (United States). [1994]. Grant N00014-91-J-1143. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Results for the equal-time spin and singlet pair field correlation functions for a two-chain Hubbard model are given. At half-filling, the dominant correlations are antiferromagnetic spin correlations characterized by a spin gap. When the system is doped away from half-filling, the antiferromagnetic correlations become incommensurate and the singlet pair field correlations appear to decay as ℓ^{-2}, similar to their U = 0 behavior. The authors have recently carried out numerical renormalization group calculations for a two-chain Hubbard model. Here they summarize what has been found for the equal-time spin and singlet pairing correlation functions for the case in which the inter and intra-chain hopping matrix elements are equal.

22836 (LA-UR–94-1148, pp. 541-544) **Impurities and conductivity in a D-wave superconductor.** Balatsky, A.V. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

It is well known that scalar impurities are pair breakers in d-wave and any other nontrivial pairing state superconductor. They produce a finite lifetime of the quasiparticles in the nodes of the gap, a finite density of states at low energy, and a finite low frequency conductivity at low temperatures, ignoring localization effects. For the special case of a 2D superconductor with a d-wave gap, a straight-forward calculation yields the suprising result that dc conductivity $\sigma(\omega \rightarrow 0)$ is a "universal" number, independent of the lifetime of quasiparticle (but dependent on the aniosotropy ratio of the velocities of the quasiparticle in the node of the gap). However, recent experiments on microwave absorption in YBCO crystals with Zn impurities show a linear temperature dependence of the conductivity for pure samples, evolving to the quadratic behavior for

higher impurity concentration, and low-temperature conductivity, inversely proportional to the impurity concentration.

22837 (LA-UR–94-1148, pp. 545-551) **The phase diagram and the spin gap state in cuprates: Gauge theory.** Lee, P.A. (Massachusetts Institute of Technology, Cambridge, MA (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DMR-90-22933. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The author analyzes the phase diagram of single and bi-layer cuprates using the gauge-field description of the t-J model. For $T > T_{BE}$ the in-plane fermion-pairing order parameter $\Delta_{||}$ is eliminated by gauge field fluctuations, leading to the prediction of the absence of a spin-gap phase in single-layer cuprates. For bi-layer cuprates the interlayer order parameter $\Delta_{\perp}$ is enhanced by spin correlations, and is less affected by gauge fluctuations. The author believes that the spin gap in bi-layer materials is due to interlayer fermion pairing, and that for these underdoped samples the superconducting gap may be nodeless.

22838 (LA-UR–94-1148, pp. 556-559) **D-wave superconductivity with a gap.** Laughlin, R.B. (Stanford Univ., CA (United States)). Los Alamos National Lab., NM (United States). [1994]. Grant DMR-88-16217. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Time-reversal symmetry breaking, the most important prediction of the "anyon" method for calculating properties of the t-J model, is not a dead concept in high-temperature superconductivity, despite the repeated failure to find T-violation experimentally. The authors believes that it may finally have been observed in experiments conducted for other purposes, and that previous failures to find it were due to pervasive dirt problems in the samples. The relevant measurements are the Josephson phase experiment of Wollman et al., which is discussed elsewhere in these proceedings, and the point-contact tunneling experiment of Hasegawa et al.

22839 (LA-UR–94-1148, pp. 563-593) **Theoretical framework for the normal state of copper oxide metals.** Varma, C.M. (AT&T Bell Laboratories, Murray Hill, NJ (United States)). Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

Every transport property in the normal metallic state of copper oxide based superconductive materials has a temperature dependence unlike that in other metals. For example, the electrical resistivity has a linear temperature dependence down to T_c and the thermal conductivity is very nearly a constant. Such long wavelength transport properties imply a transport relaxation rate τ^{-1} proportional to the temperature T. $\tau^{-1} \sim T$ can occur in metals in the classical range, for instance due to scattering from phonons or other excitations such as spin-waves at temperatures larger than their characteristic frequency. There are strong empirical and theoretical reasons, explained below, why this is not the case for copper oxide based metals. Then such a relaxation rate implies a breakdown of the quasiparticle concept. For the quasiparticle concept to hold the scattering rates must be much smaller than the energy, proportional to T, for thermal excitations. For instance, at low temperatures the scattering rate of normal metals due to electron-electron interactions is calculated and experimentally observed to be proportional to T^2, that due to electron-phonon scattering is no faster than T^3 (for 3-dimensional phonons), etc.

22840 (LA-UR–94-1148, pp. 605-608) **On the phase diagram of $La_{2-x}Sr_xCuO_4$.** Gor'kov, L.P. (National High Magnetic Field Laboratory, Tallahassee, FL (United States)); Kumar, P. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors suppose that the charge transfer gap decreases with doping resulting eventually in overlap between the electron and hole bands. The two frequencies seen in Cu NQR both in $La_{2-x}Sr_xCuO_4$ and in $La_2CuO_{4+\delta}$ are therefore ascribed to the presence of Cu configurations d^9 (local spin) and d^{10} (electrons). In an alternative approach to the three band model they find the positions for electron and hole pockets at the X and Γ points of the brillouin Zone, correspondingly.

22841 (LA-UR–94-1148, pp. 609-645) **Electronic phase separation and high temperature superconductors.** Kivelson, S.A. (UCLA, Los Angeles, CA (United States)); Emergy, V.J. Los Alamos National Lab., NM (United States). [1994]. DOE Contract AC02-76CH00016. Grant DMR-93-12606. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

The authors review the extensive evidence from model calculations that neutral holes in an antiferromagnet separate into hole-rich and hole-poor phases. All known solvable limits of models of holes in a Heisenberg antiferromagnet exhibit this behavior. They show that when the phase separation is frustrated by the introduction of long-range Coulomb interactions, the typical consequence is either a modulated (charge density wave) state or a superconducting phase. They then review some of the strong experimental evidence supporting an electronically-driven phase separation of the holes in the cuprate superconductors and the related Ni oxides. Finally they argue that frustrated phase separation in these materials can account for many of the anomalous normal state properties of the high temperature superconductors and provide the mechanism of superconductivity. In particular, they show that the T-linear resistivity of the normal state is a paraconductivity associated with a novel composite pairing, although the ordered superconducting state is more conventional.

22842 (LA-UR–94-1148, pp. 654-658) **Short coherence length superconductors: Intermediate regime between BCS and bosons.** Engelbrecht, J.R. (Los Alamos National Laboratory, NM (United States)); Randeria, M.; Sa de Melo, C. Los Alamos National Lab., NM (United States). [1994]. (CONF-931247–: Strongly correlated electronic materials, Los Alamos, NM (United States), 15-18 Dec 1993). In *Proceedings, strongly correlated electronic materials: The Los Alamos symposium 1993.* 662p. Order Number DE94009293. Source: OSTI; NTIS; INIS.

In the quest for gaining insight into the many unusual properties of the high T_c materials one can follow several complementary approaches. Instead of attempting to solve a microscopic model with strong Coulomb correlations, the authors philosophy here is to re-examine their understanding of conventional superconductors and their metallic normal states and to investigate how generalizations of the BCS pairing scenario may lead to unconventional properties.

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22843 (FEI–2353) **Theoretical and numerical analysis of the thermionic converter idle regime.** Sidel'nikov, V.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1994. 25p. (In Russian). Order Number DE95634592. Source: OSTI; NTIS (US Sales Only); INIS.

With help calculation of a single region TEC by the numerical model TEC TOR it had been produced semiempirical formula for the voltage of a single motion. Error of data interpolation by this formula do not excess ≈0.1 v. After that it has been carry out detailed analytical analysis of a single region in approximation of linear motion of electron temperature and plasma density in the interelectrode gap. It was determined, that voltage of a single region greatly depend on type of the subcollector jump of potential. This leads to unmonotonic dependence of a single motion voltage from collector work function. 5 refs.; 12 figs.

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22844 (SAND–95-0447) **Plasma technology directory.** Ward, P.P.; Dybwad, G.L. Sandia National Labs., Albuquerque, NM (United States). 1 Mar 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95011577. Source: OSTI; NTIS; INIS; GPO Dep.

The Plasma Technology Directory has two main goals: (1) promote, coordinate, and share plasma technology experience and equipment within the Department of Energy; and (2) facilitate technology transfer to the commercial sector where appropriate. Personnel are averaged first by Laboratory and next by technology area. The technology areas are accelerators, cleaning and etching deposition, diagnostics, and modeling.

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Refer also to citation(s) 22943

22845 (DOE/ER/53198–259) **The effect of collisionality and diamagnetism on the plasma dynamo.** Ji, H. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Yagi, Y.; Hattori, K.; Hirano, Y.; Shimada, T.; Maejima, Y.; Hayase, K.; Almagri, A.F.; Prager, S.C.; Sarff, J.S. Wisconsin Univ., Madison, WI (United States). Dept. of Physics. 28 Apr 1995. 17p. Sponsored by USDOE, Washington, DC (United States);Japanese Science and Technology Agency (Japan). DOE Contract FG02-85ER53198. Order Number DE95012409. Source: OSTI; NTIS; INIS; GPO Dep.

Fluctuation-induced dynamo forces are measured over a wide range of electron collisionality in the edge of TPE-1RM20 Reversed-Field Pinch (RFP). In the collisionless region the Magnetohydrodynamic (MHD) dynamo alone can sustain the parallel current, while in the collisional region a new dynamo mechanism resulting from the fluctuations in the electron diamagnetic drift becomes dominant. A comprehensive picture of the RFP dynamo emerges by combining with earlier results from MST and REPUTE RFPs.

22846 (DOE/ER/54241–138) **Single Langmuir probe characteristic in a magnetized plasma at the text tokamak.** Jachmich, S. Texas Univ., Austin, TX (United States). Fusion Research Center. May 1995. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-94ER54241. (FRCR–456). Order Number DE95012144. Source: OSTI; NTIS; INIS; GPO Dep.

A single Langmuir probe tip was used at TEXT-Upgrade to obtain I-V characteristics in a magnetized plasma. Noisy data were reduced by a boxcar-averaging routine. Unexpected effects, namely nonsaturation of ion current, hysterises in the characteristics and I(V)-data were observed, which are in disagreement to the common single probe model. A double probe model allows parameterization of the I(V) curves and to determine the plasma properties in the scrape-off layer. It is shown in this model that a Langmuir probe does perturb the local space potential in the plasma. Comparisons were made with the triple probe technique of measuring temperatures. The nonsaturation of ion current leads to an error in the triple probe technique of order 20%.

22847 (DOE/ET/53088–703) **Studies of impurity mode and ITG mode in toroidal plasmas.** Dong, J.Q. (Southwest Inst. of Physics, Chengdu, SC (China)); Horton, W. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Apr 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–703). Order Number DE95012134. Source: OSTI; NTIS; INIS; GPO Dep.

The impurity mode and η_i mode driven by impurity ions with outwardly peaked density profiles, just as it is at the boundary of tokamak plasmas, and the ion temperature gradient, respectively, are studied in high temperature toroidal plasmas. The gyrokinetic theory is applied and finite Larmor radius effects of both hydrogenic and impurity ions are included. It is found that the impurity mode is enhanced by the ion temperature gradient. In addition, the impurity ions with outwardly peaked density profiles are demonstrated to have destabilizing effects on the η_i mode. These two modes are strongly coupled to each other so that it is impossible to distinguish between them when both the driving mechanisms axe strong enough to drive the corresponding mode unstable independently. The correlation of the results with nonlinear simulations and the experimental observations are discussed.

22848 (DOE/ET/53088–707) **Nonlinear instability and chaos in plasma wave-wave interactions. II. Numerical methods and results.** Kueny, C.S.; Morrison, P.J. Texas Univ., Austin, TX (United States). Fusion Research Center. May 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–707). Order Number DE95013474. Source: OSTI; NTIS; GPO Dep.

In Part I of this work and Physics of Plasmas, June 1995, the behavior of linearly stable, integrable systems of waves in a simple plasma model was described using a Hamiltonian formulation. It was shown that explosive instability arises from nonlinear coupling between modes of positive and negative energy, with well-defined threshold amplitudes depending on the physical parameters. In this concluding paper, the nonintegrable case is treated numerically. Several sets of waves are considered, comprising systems of two and three degrees of freedom. The time evolution is modelled with an explicit symplectic integration algorithm derived using Lie algebraic methods. When initial wave amplitudes are large enough to support two-wave decay interactions, strongly chaotic motion destroys the separatrix bounding the stable region for explosive triplets. Phase space orbits then experience diffusive growth to amplitudes that are sufficient for explosive instability, thus effectively reducing the threshold amplitude. For initial amplitudes too small to drive decay instability, small perturbations might still grow to arbitrary size via Arnold diffusion. Numerical experiments do not show diffusion in this case, although the actual diffusion rate is probably underestimated due to the simplicity of the model.

22849 (EUR-CEA-FC–1507) **Theory and experiments on RF plasma heating, current drive and profile control in TORE SUPRA.** Moreau, D. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Jan 1994. 42p. (CONF-931178–: 5. international Toki conference on plasma physics and controlled nuclear fusion: physics and technology of plasma heating and current drive, Toki (Japan), 16-19 Nov 1993). Source: OSTI; NTIS (US Sales Only); INIS.

This paper reviews the main experimental and theoretical achievements related to the study of RF heating and non-inductive current drive and particularly phenomena related to the current density profile control and the potentiality of producing stationary enhanced performance regimes: description of the Lower Hybrid (LH) and Ion Cyclotron Resonant Frequency (ICRF) systems; long pulse coupling performance of the RF systems; observation of the transition to the so-called "stationary LHEP regime" in which the (flat) central current density and (peaked) electron temperature profiles are fully decoupled; experiments on ICRF sawtooth stabilization with the combined effect of LHCD modifying the current density profile; diffusion of fast electrons generated by LH waves; ramp-up experiments in which the LH power provided a significant part of the resistive poloidal flux and flux consumption scaling; theory of spectral wave diffusion and multipass absorption; fast wave current drive modelling with the Alcyon full wave code; a reflector LH antenna concept. 18 figs., 48 refs.

22850 (JINR–94-1, pp. 12-13) **μ-catalysed fusion reactions in a mixture of hydrogen isotopes.** Grebennik, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Demin, D.L.; Zhestkov, Yu.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig. MUON-CATALYZED FUSION; ELECTRON SPECTRA; HYDROGEN ISOTOPES; MUONS; PARTICLE DECAY; TRITIUM TARGET

22851 (LA-UR–95-1333) **SDOSS: A spatially discriminating, optical streaked spectrograph.** Cobble, J.; Evans, S.; Fernandez, J.; Oertel, J.; Watt, R.; Wilde, B. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract W-7405-ENG-36. (CONF-950476–1: 12. international conference on laser interaction and related plasma phenomena, Osaka (Japan), 24-28 Apr 1995). Order Number DE95012068. Source: OSTI; NTIS; INIS; GPO Dep.

SDOSS is employed to study broadband laser scattering encompassing SBS, SRS, and the 3/2-ω signature of two plasmon decay for ns-scale laser-plasma experiments with 351 or 527-nm drive. It uses a Cassegrain telescope to image scattered light from a laser plasma onto a field stop. The telescope magnification and the stop aperture provide spatial discrimination of target plane scatter. A UV lens relays the image to a 0.25-m spectrograph which is lens coupled to a streak camera with an S-1 photocathode. The streak output is imaged onto a CCD camera. In its 512 x 480 pixel array, the CCD covers a spectral range from 200 to 800 nm with 4-nm resolution and can be adjusted to look from 350 to 1,060 nm. The sweep speed is variable with full window values of 30, 12, 6 ns, and faster. An optical fiducial provides a spectral and temporal marker. On the Livermore Nova laser, SDOSS has been used to determine spatial density in gas-filled hohlraums from SRS signals. At Trident in Los Alamos, it has been employed for similar measurements with long scale length plasmas in SBS and SRS seeding experiments. It has proven to be a versatile tool for studying the physics of laser-generated plasmas.

22852 (NIFS–311) **Current-profile flattening and hot core shift due to the nonlinear development of resistive kink mode.** Watanabe, Kunihiko; Sato, Tetsuya; Nakayama, Yuichiro. National Inst. for Fusion Science, Nagoya (Japan). Oct 1994. 29p. Order Number DE95780476. Source: OSTI; NTIS; INIS.

A new and interesting phenomenon showing that the toroidal current profile for the n=0 mode, which at first exhibits a peak due to ohmic heating and later flattens around the magnetic axis, is obtained through a compressible resistive MHD simulation in a fully 3-D toroidal geometry. We conclude through a detailed analysis that the current flattening is caused by the strong excitation of a nonlinear resistive kink mode. The time-scale of the current profile flattening is of the order of the MHD time-scale. When the current profile is largely flattened, the plasma dynamic pressure due to the strongly excited kink mode pushes the hot core plasma in the radial kink flow direction and the hot core starts deviating from the magnetic surface because of the plasma compressibility and the dynamic pressure. Since the flattening of a current profile weakens the shear effect of the poloidal magnetic field in the $q<1$ region where the resistive kink mode is growing, the poloidal magnetic field reconnection is driven by the strong kink flow and leads to complete destruction of the magnetic surface within the q=1 rational surface (minor disruption), and the poloidal magnetic field configuration recovers to an axi-symmetric profile. The effect of the thermal conduction on the evolution of such a process is also discussed. (author).

22853 (NIFS–312) **Modification and damping of Alfven waves in a magnetized dusty plasma.** Salimullah, M.; Dasgupta, B.; Watanabe, K.; Sato, T. National Inst. for Fusion Science, Nagoya (Japan). Oct 1994. 20p. Order Number DE95780463. Source: OSTI; NTIS; INIS.

The dispersion characteristics of the circularly polarized electromagnetic waves along a homogeneous magnetic field in a dusty plasma have been investigated theoretically. The Vlasov equation has been employed to find the response of the magnetized plasma particles where the dust grains form a static background of highly charged and massive centers having certain correlation. It is found that in addition to the usual Landau damping which is negligible in the low temperature approximation, a novel mechanism of damping of the Alfven waves due to the dust comes into play. The modification and damping of the Alfven waves depend on the dust perturbation parameters, unequal densities of plasma particles, the average correlation length of the dust grains, temperature of the plasma and the magnetic field. (author).

22854 (NIFS–313) **Physical mechanism determining the radial electric field and its radial structure in a toroidal plasma.** Ida, Katsumi (and others); Miura, Yukitoshi; Itoh, Sanae. National Inst. for Fusion Science, Nagoya (Japan). Oct 1994. 67p. Order Number DE95780475. Source: OSTI; NTIS; INIS.

Radial structures of plasma rotation and radial electric field are experimentally studied in tokamak, heliotron/torsatron and stellarator devices. The perpendicular and parallel viscosities are measured. The parallel viscosity, which is dominant in determining the toroidal velocity in heliotron/torsatron and stellarator devices, is found to be neoclassical. On the other hand, the perpendicular viscosity, which is dominant in dictating the toroidal rotation in tokamaks, is anomalous. Even without external momentum input, both a plasma rotation and a radial electric field exist in tokamaks and heliotrons/torsatrons. The observed profiles of the radial electric field do not agree with the theoretical prediction based on neoclassical transport. This is mainly due to the existence of anomalous perpendicular viscosity. The shear of the radial electric field improves particle and heat transport both in bulk and edge plasma regimes of tokamaks. (author) 95 refs.

22855 (NIFS–314) **Non-Taylor magnetohydrodynamic self-organization.** Zhu, Shao-ping; Horiuchi, Ritoku; Sato, Tetsuya. National Inst. for Fusion Science, Nagoya (Japan). Oct 1994. 45p. Order Number DE95780464. Source: OSTI; NTIS; INIS.

A self-organization process in a plasma with a finite pressure is investigated by means of a three-dimensional magnetohydrodynamic simulation. It is demonstrated that a non-Taylor finite β self-organized state is realized in which a perpendicular component of the electric current is generated and the force-free(parallel) current decreases until they reach to almost the same level. The self-organized state is described by an MHD force-balance relation, namely, $j_{perpendicular} = B \times \nabla p/B \cdot B$ and $j_{parallel} = \mu B$ where μ is not a constant, and the pressure structure resembles the structure of the toroidal magnetic field intensity. Unless an anomalous perpendicular thermal conduction arises, the plasma cannot relax to a Taylor state but to a non-Taylor (non-force-free) self-organized state. This state becomes more prominent for a weaker resistivity condition. The non-Taylor state has a rather universal property, for example, independence of the initial β value. Another remarkable finding is that the Taylor's conjecture of helicity conservation is, in a strict sense, not valid. The helicity dissipation occurs and its rate slows down critically in accordance with the stepwise relaxation of the magnetic energy. It is confirmed that the driven magnetic reconnection caused by the nonlinearly excited plasma kink flows plays the leading role in all of these key features of the non-Taylor self-organization. (author).

22856 (NIFS–315) **Collisionless magnetic reconnection associated with coalescence of flux bundles.** Tanaka, Motohiko. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 40p. Order Number DE95780473. Source: OSTI; NTIS; INIS.

The basic process of collisionless reconnection is studied in terms of coalescence of magnetized flux bundles using an implicit particle simulation of two-dimensions. The toroidal electric field that directly relates to magnetic reconnection is generated solenoidally in a region much broader than the current sheet whose width is a few electron skin depths. The reconnected flux increases linearly in time, but it is insensitive to finite Larmor radii of the ions in this Sweet-Parker regime. The toroidal electric field is controlled by a balance of transit acceleration of finite-mass electrons and their removal by sub-Alfvenic E x B drift outflow. The simulation results supports the collisionless Ohm's law $E_t \simeq \eta_{eq} J_t$ with η_{eq} the inertia resistivity. (author).

22857 (NIFS–316) **Macro-EM particle simulation method and a study of collisionless magnetic reconnection.** Tanaka, Motohiko. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 48p. Order Number DE95780465. Source: OSTI; NTIS; INIS.

A multi-dimensional electromagnetic particle simulation method which is suitable for studying low-frequency plasma phenomena is described in the first part. Its application to collisionless magnetic reconnection is shown in the second part. The present particle code efficiently deals with nonlinear kinetic processes wherein ions and electrons play their roles, since the code is implemented using the Maxwell equations and the Newton-Lorentz equations. The drift-kinetic equations are used optionally. A simulation of collisionless reconnection shows that the toroidal electric field which directly relates to reconnection is generated naturally in the kinetic study, and that a thin dissipation region is formed whose width is a

few electron skin depth. Thus, collisionless reconnection is considered to proceed under the electron inertia. (author).

22858 (NIFS–317) **Second order focusing property of 210deg cylindrical energy analyzer.** Fujisawa, A.; Iguchi, H.; Sasao, M.; Hamada, Y. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 21p. Order Number DE95780470. Source: OSTI; NTIS; INIS.

It was confirmed experimentally that a 210deg cylindrical energy analyzer with drift spaces has second order focusing. The properties of the analyzer is deeply dependent on the fringing field around the entrance and exit of the cylinders. (author).

22859 (NIFS–318) **Complexity in plasma. A grand view of self-organization.** Sato, Tetsuya. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 28p. Order Number DE95780478. Source: OSTI; NTIS; INIS.

The central theme of the Complexity is the inquest of the creation of ordered structure in nature. Extensive computer simulations on plasmas have revealed that self-organization is governed by the three key processes, i.e. energy pumping, entropy expulsion and nonlinearity. A system exhibits characteristically different self-organization, depending on whether the energy pumping is instantaneous or continuous, or whether the produced entropy is expulsed or reserved. The nonlinearity acts to bring a nonequilibrium state into a bifurcation, thus resulting in a new structure along with an anomalous entropy production. (author).

22860 (NIFS–319) **MHD-Vlasov simulation of the toroidal Alfven eigenmode.** Todo, Y.; Sato, T.; Watanabe, K.; Watanabe, T.H.; Horiuchi, R. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 30p. Order Number DE95780471. Source: OSTI; NTIS; INIS.

A new simulation method has been developed to investigate the excitation and saturation processes of toroidal Alfven eigenmodes (TAE modes). The background plasma is described by a full-MHD fluid model, while the kinetic evolution of energetic alpha particles is followed by the drift kinetic equation. The magnetic fluctuation of $n = 2$ mode develops and saturates at the level of 1.8×10^{-3} of the equilibrium field when the initial beta of alpha particles is 2% at the magnetic axis. After saturation, the TAE mode amplitude shows an oscillatory behavior with a frequency corresponding to the bounce frequency of the alpha particles trapped by the TEA mode. The decrease of the power transfer rate from the alpha particles to the TAE mode, which is due to the trapped particle effect of a finite-amplitude wave, causes the saturation. From the linear growth rate the saturation level can be estimated. (author).

22861 (NIFS–321) **Theory of pressure-induced islands and self-healing in three-dimensional toroidal magnetohydrodynamic equilibria.** Bhattacharjee, A.; Hayashi, T.; Hegna, C.C.; Nakajima, N.; Sato, T. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 26p. Order Number DE95780472. Source: OSTI; NTIS; INIS.

The role of singular currents in three-dimensional toroidal equilibria and their resolution by magnetic island formation is discussed from both analytical and computational points of view. Earlier analytical results are extended to include small vacuum islands which may, in general, have different phases with respect to pressure-induced islands. In currentless stellarators, the formation of islands is shown to depend on the resistive parameter D_R as well as the integrated effect of global Pfirsch-Schlueter currents. It is demonstrated that the pressure-induced 'self-healing' effect, recently discovered computationally, is also predicted by analytical theory. (author).

22862 (NIFS–327) **Fast potential change in sawteeth in JIPP T-IIU tokamak plasmas.** Hamada, Y. (and others); Nishizawa, A.; Kawasumi, Y. National Inst. for Fusion Science, Nagoya (Japan). Dec 1994. 26p. Order Number DE95780468. Source: OSTI; NTIS; INIS.

Fast changes of electric potential with different polarities are observed during sawtooth oscillation in a core region of a tokamak plasma using a heavy ion beam probe. The potential change inside the inversion radius is found to be positive. The change is negative outside the inversion radius and shows clearly a propagation nature. The observed potential can be interpreted by the mixture of the potentials of two origins. One of them drives the fast MHD plasma motion through E/B drift and the other is a barrier potential induced by mixing of hot and cold plasmas at sawtooth crash. (author).

22863 (NIFS–328) **Effect of satellite helical harmonics on the stellarator configuration.** Pustovitov, V.D. National Inst. for Fusion Science, Nagoya (Japan). Dec 1994. 46p. Order Number DE95780477. Source: OSTI; NTIS; INIS.

We discuss the problem of self-consistent analytical description of stellarators with a helical field which has, besides the main harmonic, two nearest satellites with the same period in the toroidal angle. The expression for the flux function explicitly incorporating the effect of such satellites on the shape of magnetic surfaces is obtained. It is shown that they produce the shift of magnetic surfaces. The expression for this shift is derived. Two problems are considered where the behavior of B^2 on a magnetic surface is important: Pfirsch-Schlueter current at the presence of satellites and possibility of fulfillment of quasisymmetry condition (B^2 on a magnetic surface does not depend on one of the angular Boozer coordinates) at least at a single magnetic surface. It is shown that effect of satellite harmonics on the magnitude of Pfirsch-Schlueter current turns out to be much smaller than it was predicted earlier on the basis of simplified model where the shift related with satellites was not taken into account. It is shown that quasisymmetry condition in a configuration with two satellites can be fulfilled only in linear approximation in helical field. The analysis is performed for conventional stellarators with planar circular axis making use of stellarator expansion. (author) 54 refs.

22864 (NIFS-MEMO–15) **Study on sawtooth and transport. A report of Japan-TEXTOR collaboration.** Itoh, S. (Kyushu Univ., Kasuga, Fukuoka (Japan). Research Inst. for Applied Mechanics); Itoh, K.; Soltwisch, H.; Finken, K.H. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 24p. (In Japanese, English). Order Number DE95780474. Source: OSTI; NTIS; INIS.

A collaboration programme is initiated, in part of the Japan-TEXTOR collaboration, for the theoretical and experimental study on the sawtooth and anomalous transport. The summary of the workshop in 1994 is reported. (author).

22865 (PPPL–3108) **Absolute calibration of TFTR helium proportional counters.** Strachan, J.D. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Diesso, M.; Jassby, D.; Johnson, L.; McCauley, S.; Munsat, T.; Roquemore, A.L.; Barnes, C.W.; Loughlin, M. Princeton Univ., NJ (United States). Plasma Physics Lab. Jun 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-940552–47: 10. topical conference on high-temperature plasma diagnostics, Rochester, NY (United States), 8-12 May 1994). Order Number DE95013483. Source: OSTI; NTIS; INIS; GPO Dep.

The TFTR helium proportional counters are located in the central five (5) channels of the TFTR multichannel neutron collimator. These detectors were absolutely calibrated using a 14 MeV neutron generator positioned at the horizontal midplane of the TFTR vacuum vessel. The neutron generator position was scanned in centimeter steps to determine the collimator aperture width to 14 MeV neutrons and the absolute sensitivity of each channel. Neutron profiles were measured for TFTR plasmas with time resolution between 5 msec and 50 msec depending upon count rates. The He detectors were used to measure the burnup of 1 MeV tritons in deuterium plasmas, the transport of tritium in trace tritium experiments, and the residual tritium levels in plasmas following 50:50 DT experiments.

22866 (UCRL-ID–120004) **LDRD Final report.** Stewart, R.E.; Price, D.; Shepherd, R.; White, W.; Walling, R.; More, R. Lawrence Livermore National Lab., CA (United States). 16 Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012110. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this project is to develop a 100-fs pulse length laser capable of heating solid density plasmas to near-kilovolt temperatures before hydrodynamic decompression of the target can take

place, and to experimentally determine the properties of these plasmas with it. The authors have successfully developed the laser for this work and measured plasma production and laser absorption with it. This work has demonstrated the capacity to produce solid-density plasmas. Future experiments are described.

22867 (UCRL-ID–120116) **UEDGE code comparisons with DIII-D bolometer DATA.** Daniel, J.M. Lawrence Livermore National Lab., CA (United States); General Atomics, San Diego, CA (United States). Jan 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; AC03-89ER51114. Order Number DE95013294. Source: OSTI; NTIS; GPO Dep.

This paper describes the work done to develop a bolometer post processor that converts volumetric radiated power values taken from a UEDGE solution, to a line integrated radiated power along chords of the bolometers in the DIII-D tokamak. The UEDGE code calculates plasma physics quantities, such as plasma density, radiated power, or electron temperature, and compares them to actual diagnostic measurements taken from the scrape off layer (SOL) and divertor regions of the DIII-D tokamak. Bolometers are devices measuring radiated power within the tokamak. The bolometer interceptors are made up of two complete arrays, an upper array with a vertical view and a lower array with a horizontal view, so that a two dimensional profile of the radiated power may be obtained. The bolometer post processor stores line integrated values taken from UEDGE solutions into a file in tabular format. Experimental data is then put into tabular form and placed in another file. Comparisons can be made between the UEDGE solutions and actual bolometer data. Analysis has been done to determine the accuracy of the plasma physics involved in producing UEDGE simulations.

22868 (UCRL-JC–118380) **Micron-scale resolution radiography of laser-accelerated and laser-exploded foils using an yttrium x-ray laser.** Cauble, R.; Da Silva, L.B.; Barbee, T.W. Jr.; Celliers, P.; Moreno, J.C.; Mrowka, S.; Perry, T.S.; Wan, A.S. Lawrence Livermore National Lab., CA (United States). Sep 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940592–11: 4. international colloquium on X-ray lasers, Williamsburg, VA (United States), 16-20 May 1994). Order Number DE95010922. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have imaged laser-accelerated foils and exploding foils on the few-micron scale using an yttrium x-ray laser (155 Å, 80 eV, ~200 ps duration) and a multilayer mirror imaging system. At the maximum magnification of 30, resolution was of order one micron. The images were side-on radiographs of the foils. Accelerated foils showed significant filamentation on the rear-side (away from the driving laser) of the foil, although the laser beam was smoothed. In addition to the narrow rear-side filamentation, some shots revealed larger-scale plume-like structures on the front (driven) side of the Al foil. These plumes seem to be little-affected by beam smoothing and are likely a consequence of Rayleigh-Taylor instability. The experiments were carried out at the Nova two-beam facility.

22869 (UCRL-JC–119283) **A comparison of fundamental and second harmonic inside launch ECCD in the presence of a DC electric field.** James, R.A. (Lawrence Livermore National Lab., CA (United States)); Petty, C.C.; Harvey, R.W. Lawrence Livermore National Lab., CA (United States); General Atomics, San Diego, CA (United States). 6 Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; AC03-89ER51114. (GA--A21994; CONF-950112–2: 9. joint workshop on electron cyclotron emission and electron cyclotron resonance heating, Borrego Springs, CA (United States), 23-26 Jan 1995). Order Number DE95009847. Source: OSTI; NTIS; GPO Dep.

Using inside launch, both fundamental and second harmonic Electron Cyclotron Current Drive (ECCD) experiments have been performed in the DIII-D tokamak. Rf currents up to 100 kA have been driven using launched powers up to 1.1 MW. These experiments are characterized by thermal target plasmas with electron temperatures and densities sufficient to result in strong localized deposition of the rf power and good confinement of the rf generated current carriers. A residual dc electric field significantly enhances the current drive efficiency above that predicted by linear theory. The effects of the residual dc electric field are evaluated using a bounce averaged 3D Fokker-Planck code to model the experimental data. For both fundamental and second harmonic ECCD, the measured rf current drive efficiency is found to increase with the residual dc electric field in accordance with theoretical predictions.

22870 (UCRL-JC–119826) **The development of a distributed computing environment for the design and modeling of plasma spectroscopy experiments.** Nash, J.K. (Lawrence Livermore National Lab., CA (United States)); Eme, W.G.; Lee, R.W.; Salter, J.M. Lawrence Livermore National Lab., CA (United States). Oct 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410314–3: 6. international workshop on radiative properties of hot dense matter, Sarasota, FL (United States), 31 Oct - 4 nov 1994). Order Number DE95011725. Source: OSTI; NTIS; INIS; GPO Dep.

The design and analysis of plasma spectroscopy experiments can be significantly complicated by relatively routine computational tasks arising from the massive amount of data encountered in the experimental design and analysis stages of the work. Difficulties in obtaining, computing, manipulating and visualizing the information represent not simply an issue of convenience – they have a very real limiting effect on the final quality of the data and on the potential for arriving at meaningful conclusions regarding an experiment. We describe ongoing work in developing a portable UNIX environment shell with the goal of simplifying and enabling these activities for the plasma-modeling community. Applications to the construction of atomic kinetics models and to the analysis of x-ray transmission spectroscopy will be shown.

22871 (UCRL-JC–121089) **Stability of the DSI algorithm on a chevron grid.** Brandon, S.T.; Rambo, P.W. Lawrence Livermore National Lab., CA (United States). Jun 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950612–1: 22. international conference on plasma science, Madison, WI (United States), 5-8 Jun 1995). Order Number DE95013790. Source: OSTI; NTIS; INIS; GPO Dep.

The development of time domain electromagnetic solvers for nonorthogonal grids is an area of current research interest, stemming from the need to simulate complex geometries in a wide variety of applications. A notable example is the discrete surface integral (DSI) algorithm which solves the Maxwell curl equations in the time domain using a 3d, unstructured, mixed-polyhedral grid. Although this method is an extension of the time proven Yee algorithm, little is known about the numerical properties of the method when discretized on these more general grids. Dispersion relations for the DSI algorithm can be derived using 2d idealized grids, such as the skewed mesh analysis done by Ray and Rambo for both triangles and quadrilaterals. The present work applies the same techniques used for the skewed mesh analysis to another idealized, but nonorthogonal, 2d grid.

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22872 (ANL/ET/CP–83726) **Fabrication of intermetallic coatings for electrical and corrosion resistance on high-temperature alloys.** Park, J.H. (Argonne National Lab., IL (United States)); Cho, W.D. Argonne National Lab., IL (United States). Oct 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950201–18: Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS), Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95012947. Source: OSTI; NTIS; GPO Dep.

Several intermetallic films were fabricated to high-temperature alloys (V-alloys and 304 and 316 stainless steels) to provide electrical insulation and corrosion resistance. Alloy grain-growth behavior at 1000°C for the V-5Cr-5Ti was investigated to determine the stability of alloy substrate during coating formation by chemical vapor deposition (CVD) or metallic vapor processes at 800-850°C. Film layers were examined by optical and scanning electron microscopy and by electron-energy-dispersive and X-ray diffraction analysis

and tested for electrical resistivity and corrosion resistance. The results elucidated the nature of the coatings, which provided both electrical insulation and high-temperature corrosion protection.

22873 (ANL/ET/CP–84955) **Self-healing of defects in CaO coatings on V-5%Cr-5%Ti in liquid lithium.** Park, J.H.; Kassner, T.F. Argonne National Lab., IL (United States). Nov 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950518–10: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013468. Source: OSTI; NTIS; INIS; GPO Dep.

In-situ electrical resistance of CaO coatings produced on V-5%Cr-5%Ti by exposure of the alloy to liquid Li that contained 0.5-85 wt % dissolved Ca was measured as a function of time at temperatures between 250 and 600°C. Examination of the specimens after cooling to room temperature revealed no spallation, but homogeneous crazing cracks were present in the CaO coating. Additional tests to investigate the in-situ self-healing behavior of the cracks indicated that rapid healing occurred at >360°C.

22874 (ANL/FPP/TM–281) **Summary report for ITER Task-T19: MHD pressure drop and heat transfer study for liquid metal systems.** Reed, C.B. (Argonne National Lab., IL (United States)); Hua, T.Q.; Natesan, K.; Kirillov, I.R.; Vitkovski, I.V.; Anisimov, A.M. Argonne National Lab., IL (United States). Mar 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (ITER/US–95/IV-BL-05). Order Number DE95011968. Source: OSTI; NTIS; INIS; GPO Dep.

A key feasibility issue for the ITER Vanadium/Lithium breeding blanket is the question of insulator coatings. Design calculations show that an electrically insulating layer is necessary to maintain an acceptably low MHD pressure drop. To begin experimental investigations of the MHD performance of candidate insulator materials and the technology for putting them in place, a new test section was prepared. Aluminum oxide was chosen as the first candidate insulating material because it may be used in combination with NaK in the ITER vacuum vessel and/or the divertor. Details on the methods used to produce the aluminum oxide layer as well as the microstructures of the coating and the aluminide sublayer are presented and discussed. The overall MHD pressure drop, local MHD pressure gradient, local transverse MHD pressure difference, and surface voltage distributions in both the circumferential and the axial directions are reported and discussed. The positive results obtained here for high-temperature NaK have two beneficial implications for ITER. First, since NaK may be used in the vacuum vessel and/or the divertor, these results support the design approach of using electrically insulating coatings to substantially reduce MHD pressure drop. Secondly, while Al_2O_3/SS is not the same coating/base material combination which would be used in the advanced blanket, this work nonetheless shows that it is possible to produce a viable insulating coating which is stable in contact with a high temperature alkali metal coolant.

22875 (CONF-950506–14) **Tritium proof-of-principle pellet injector - phase II.** Fisher, P.W.; Gouge, M.J. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on tritium technology in fission, fusion and isotopic applications; Ispra (Italy); 28 May - 3 jun 1995. Order Number DE95013217. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the International Thermonuclear Engineering Reactor (ITER) plasma fueling development program, Oak Ridge National Laboratory (ORNL) has fabricated a pellet injection system to test the mechanical and thermal properties of extruded tritium. This repeating, single-stage, pneumatic injector, called the Tritium-Proof-of-Principle Phase II (TPOP-II) Pellet Injector, has a piston-driven mechanical extruder and is designed to extrude hydrogenic pellets sized for the ITER device. The TPOP-II program has the following development goals: evaluate the feasibility of extruding tritium and DT mixtures for use in future pellet injection systems; determine the mechanical and thermal properties of tritium and DT extrusions; integrate, test and evaluate the extruder in a repeating, single-stage light gas gun sized for the ITER application (pellet diameter ~ 7-8 mm); evaluate options for recycling propellant and extruder exhaust gas; evaluate operability and reliability of ITER prototypical fueling systems in an environment of significant tritium inventory requiring secondary and room containment systems. In initial tests with deuterium feed at ORNL, up to thirteen pellets have been extruded at rates up to 1 Hz and accelerated to speeds of order 1.0-1.1 km/s using hydrogen propellant gas at a supply pressure of 65 bar. The pellets are typically 7.4 mm in diameter and up to 11 mm in length and are the largest cryogenic pellets produced by the fusion program to date. These pellets represent about a 11% density perturbation to ITER. Hydrogenic pellets will be used in ITER to sustain the fusion power in the plasma core and may be crucial in reducing first wall tritium inventories by a process called isotopic fueling where tritium-rich pellets fuel the burning plasma core and deuterium gas fuels the edge.

22876 (DOE/ER/52149–3) **[Fluid dynamics of supercritical helium within internally cooled cabled superconductors. Annual report].** Van Sciver, S.W. Wisconsin Univ., Madison, WI (United States). [1990]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER52149. Order Number DE95012153. Source: OSTI; NTIS; GPO Dep.

The Applied Superconductivity Center of the University of Wisconsin-Madison proposes to conduct research on low temperature helium fluid dynamics as it applies to the cooling of internally cooled cabled superconductors. Such conductors are used in fusion reactor designs including most of the coils in ITER. The proposed work is primarily experimental involving measurements of transient and steady state pressure drop in a variety of conductor configurations. Both model and prototype conductors for actual magnet designs will be investigated. The primary goal will be to measure and model the friction factor for these complex geometries. In addition, an effort will be to study transient processes such as heat transfer and fluid expulsion associated with quench conditions.

22877 (DOE/ER/52149–T1) **Final report on fluid dynamics of supercritical helium within cable-in-conduit conductors.** Van Sciver, S.W. Wisconsin Univ., Madison, WI (United States). 1 Jul 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER52149. Order Number DE95012147. Source: OSTI; NTIS; GPO Dep.

The enclosed report summarizes work carried out under DOE/MFE support during the past four years. Emphasis is placed on progress during the last year. Results of experiments on pressure drop and heat transfer within several Cable-in-Conduit conductors are described. These results are compared to models developed for flow in similar geometries. The work provides a basis for design of magnets using CIC conductors in fusion magnetic systems.

22878 (DOE/ER/54176–T1) **TRAP - Tokamak Refueling by Accelerated Plasmoids. Annual progress report No. 3, August 7, 1994–August 6, 1995.** Hoffman, A.L.; Slough, J.T. Washington Univ., Seattle, WA (United States). Aerospace and Energetics Research Program. [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-92ER54176. Order Number DE95009925. Source: OSTI; NTIS; INIS; GPO Dep.

This is the annual progress report for the period August 7, 1994 to August 6, 1995. This project is to demonstrate the ability to generate, accelerate, and inject plasmoids into a tokamak type magnetic geometry with the purpose being plasma fueling. The hardware has been assembled and constructed. Early test results have shown some unexpected problems which have been addressed. These and other delivery problems have extended the assembly phase and the authors are requesting a six month extension to allow adequate time for experimentation with the apparatus.

22879 (JAERI-Tech–94-037) **Development of piezoelectric actuator gas injection valve for JT-60U.** Hiratsuka, Hajime (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Miyo, Yasuhiko; Koike, Tsuneyuki; Shimizu, Masatsugu; Komuro, Ken-ichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1995. 49p. (In Japanese). Order Number DE95780675. Source: OSTI; NTIS; INIS.

Piezoelectric actuator gas injection valve by lever for JT-60U have been developed using piezoelectric actuator (Laminated piezoelectric elements). Specifications of the valve are summarized as follows: (1) The piezoelectric actuator gas injection valve by lever (LE-PEV) is the same configuration as the low flow rate

piezoelectric valve (PEV-L), (2) The laminated piezoelectric element is used as actuator, (3) The massflow rate is up to 30.7 Pam^3/s for hydrogen, 0.2 MPa back pressure, 150 V, (4) The sheet leak rate using helium as a probing gas is smaller than $1.33x10^{-8}$ Pam^3/s, (5) The operating voltage is 0 - 150 V. Judging from these results performances of LE-PEV for the actual operation condition of JT-60U is good. (author).

22880 (LA-UR–95-1306) **Multimode hydrodynamic stability calculations for National Ignition Facility capsules.** Hoffman, N.M.; Wilson, D.C.; Varnum, W.S.; Krauser, W.J.; Wilde, B.H. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950476–3: 12. international conference on laser interaction and related plasma phenomena, Osaka (Japan), 24-28 Apr 1995). Order Number DE95012073. Source: OSTI; NTIS; INIS; GPO Dep.

The authors examine the hydrodynamic stability of imploding ICF capsules by explicitly calculating, the evolution of a realistic surface perturbation far into its nonlinear regime, using, a 2D Lagrangian radiation-hydrodynamics code. The perturbation, which consists initially of mesh displacements in the capsule, is represented by the sum of many spherical harmonic modes, having finite amplitudes and realistic spectrum. A 90-degree sector of the capsule is modeled, allowing proper boundary conditions for all modes simultaneously. Because of the large distortion of the mesh that occurs during the calculations, it is necessary to rezone the mesh frequently, by mapping physical variables to a new undistorted mesh. No model-specific parameters are required in this technique. The authors have used the technique to calculate the yield of several designs for a National Ignition Facility capsule as a function of initial root-mean-square surface roughness σ of the outer ablator surface or the inner cryogenic DT surface. Typically for a capsule they find a "cliff" at a critical value of $\sigma = \sigma_{crit}$ such that the yield of the capsule decreases abruptly for $\sigma > \sigma_{crit}$, indicating a failure to ignite. The values of σ_{crit} they compute are probably upper limits because of the lack of 3D effects, and inaccuracies in Lagrangian modeling of such unstable flows. It is expected that more accurate modeling, perhaps with 3D Eulerian codes, will lead to smaller values for σ_{crit}. They are beginning to carry out studies of the coupling of low-mode radiation flux asymmetries to higher-mode surface perturbations. They report also on sensitivity studies that examine the response of a capsule to small variations in the driving laser's power history. They find that realistic surfaces decrease a capsule's ability to tolerate drive variations.

22881 (LA-UR–95-1350) **Modeling of drive-symmetry experiments in gas-filled hohlraums at Nova.** Lindman, E.L. (Los Alamos National Lab., NM (United States)); Magelssen, G.R.; Delamater, E.L.; Hauer, A.A.; Wilde, B.H.; Powers, L.V.; Murphy, T.J.; Pollaine, S.M.; Suter, L.J. Los Alamos National Lab., NM (United States); Lawrence Livermore National Lab., CA (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ; W-7405-ENG-48. (CONF-950476–2: 12. international conference on laser interaction and related plasma phenomena, Osaka (Japan), 24-28 Apr 1995). Order Number DE95012065. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments on capsule implosions in gas-filled hohlraums have been carried out on the NOVA Laser at Lawrence Livermore National Laboratory. Observed capsule shapes are more oblate than predicted using modeling methods which agree well with experiments in evacuated hohlraums. Improvements in modeling required to calculate these experiments and additional experiments are being pursued.

22882 (NIFS–322) **Recent studies of the large helical device.** Iiyoshi, Atsuo; Yamazaki, Kozo. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 15p. Order Number DE95780466. Source: OSTI; NTIS; INIS.

The Large Helical Device (LHD) is presently under construction (1990-1997) in NIFS, Japan. The magnetic configuration is chosen as an optimized heliotron with double helix coils, succeeding Heliotron-E, ATF and CHS. Target plasma parameters of the LHD with fully superconducting coil systems are; $n\tau_E T$-10^{20} $m^{-3}\cdot s\cdot keV$, β-bar=5% and steady operations with R_p=3.75m, a_p=50-65cm and B_0=3-4T. The major objectives of the LHD project are to demonstrate good plasma confinement, high beta achievement and steady-state divertor operation in the helical system. Various R and D results have been obtained on superconducting coils, negative ion source and special diagnostics for LHD. In our new site (Tokicity, Gifu-prefecture), the construction of the main experimental hall of the LHD Building was finished, and the winding of the helical coil has been started there. The construction of LHD will be completed in 1997. (author).

22883 (NIFS–323) **The next large helical devices.** Iiyoshi, Atsuo; Yamazaki, Kozo. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 34p. Order Number DE95780467. Source: OSTI; NTIS; INIS.

Helical systems have strong merits of steady-state operations for fusion reactors. Two large helical devices with fully superconducting coil systems are presently under design and construction. One is the LHD (Large Helical Device, major radius = 3.9m, magnetic field = 3-4T, under construction during 1990-1997) in NIFS (National Institute for Fusion Science)-Nagoya/Toki, Japan, which provides with continuous helical coils and clean helical divertor focusing on edge configuration optimization. The other one is the W7-X (Wendelstein 7-X, major radius = 5.5m, magnetic field = 3T, under approval) in MPIPP (Max-Planck Institute for Plasma Physics)-Garching, Germany, which adopted a modular coil system after elaborate optimization studies of core plasma physics. These two programs are complementary to promote world helical fusion research and to extend the comprehensive understanding of toroidal plasmas by comparing with large tokamaks. (author).

22884 (NIFS–324) **Quasisymmetry equations for conventional stellarators.** Pustovitov, V.D. National Inst. for Fusion Science, Nagoya (Japan). Nov 1994. 24p. Order Number DE95780479. Source: OSTI; NTIS; INIS.

General quasisymmetry condition, which demands the independence of B^2 on one of the angular Boozer coordinates, is reduced to two equations containing only geometrical characteristics and helical field of a stellarator. The analysis is performed for conventional stellarators with a planar circular axis using standard stellarator expansion. As a basis, the invariant quasisymmetry condition is used. The quasisymmetry equations for stellarators are obtained from this condition also in an invariant form. Simplified analogs of these equations are given for the case when averaged magnetic surfaces are circular shifted torii. It is shown that quasisymmetry condition can be satisfied, in principle, in a conventional stellarator by a proper choice of two satellite harmonics of the helical field in addition to the main harmonic. Besides, there appears a restriction on the shift of magnetic surfaces. Thus, in general, the problem is closely related with that of self-consistent description of a configuration. (author).

22885 (NIFS–326) **New pellet production and acceleration technologies for high speed pellet injection system 'HIPEL' in large helical device.** Viniar, I. (Saint-Petersburg Technical Univ. (Russian Federation)); Sudo, S. National Inst. for Fusion Science, Nagoya (Japan). Dec 1994. 28p. Order Number DE95780469. Source: OSTI; NTIS; INIS.

New technologies of pellet production and acceleration for fueling and diagnostics purposes in large thermonuclear reactors are proposed. The technologies are intended to apply to the multiple-pellet injection system 'HIPEL' for Large Helical Device of NIFS in Japan. The pellet production technology has already been tested in a pipe-gun type pellet injector. It will realize the repeating pellet injection by means of decreasing of the pellet formation time into the pipe-gun barrel. The acceleration technology is based upon a new pump tube operation in two-stage gas gun and also upon a new conception of the allowable pressure acting on a pellet into a barrel. Some preliminary estimations have been made, and principles of a pump tube construction providing for a reliable long term operation in the repeating mode without any troubles from a piston are proposed. (author).

22886 (UCRL-CR–120302-Pt.1) **Final report Task Order Number B239641 between the Regents of the University of California and Institute of Experimental Physics task 1: Conceptual design. Part 1.** Galakhov, I.V. (Russian Federal Nuclear

Center (Russian Federation)); Kirillov, G.A.; Murugov, V.M. Lawrence Livermore National Lab., CA (United States); Russian Federal Nuclear Center (Russian Federation). Nov 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013270. Source: OSTI; NTIS; INIS; GPO Dep.

The current worldwide developmental status of high power lasers and pumping systems for laser ignition facilities is presented. Design philosophies of pulsed power systems for laser fusion (LF) research facilities are discussed. A conceptual design of the facility pulsed power systems is discussed in detail. In conclusion, a thorough analysis of current worldwide LF research is given.

22887 (UCRL-ID–119916) **Scaling laws for specialized hohlraums.** Rosen, M.D. Lawrence Livermore National Lab., CA (United States). 28 Sep 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013291. Source: OSTI; NTIS; INIS; GPO Dep.

The author presents scaling laws for the behavior of hohlraums that are somewhat more complex than a simple sphere or cylinder. In particular the author considers hohlraums that are in what has become known as a "primary" "secondary" configuration, namely geometries in which the laser is absorbed in a primary region of a hohlraum, and only radiation energy is transported to a secondary part of the hohlraum that is shielded from seeing the laser light directly. Such hohlraums have been in use of late for doing LTE opacity experiments on a sample in the secondary and in recently proposed "shimmed" hohlraums that use gold disks on axis to block a capsule's view of the cold laser entrance hole. The temperature/drive of the secondary, derived herein, scales somewhat differently than the drive in simple hohlraums.

22888 (UCRL-JC–117325) **Preparation of germanium doped plasma polymerized coatings as ICF target ablators.** Brusasco, R.M.; Saculla, M.D.; Cook, R.C. Lawrence Livermore National Lab., CA (United States). 5 Oct 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-941001–15: 41. annual American Vacuum Society symposium, Denver, CO (United States), 24-28 Oct 1994). Order Number DE95012470. Source: OSTI; NTIS; INIS; GPO Dep.

Targets for Inertial Confinement Fusion (ICF) experiments at the Lawrence Livermore National Laboratory (LLNL) utilize an organic (CH) ablator coating prepared by plasma polymerization. Some of these experiments require a mid-Z dopant in the ablator coating to modify the opacity of the shell. Bromine had been used in the past, but the surface finish of brominated CH degrades rapidly with time upon exposure to air. This paper describes the preparation and characterization of plasma polymer layers containing germanium as a dopant at concentrations of between 1.25 and 2.25 atom percent. The coatings are stable in air and have an rms surface roughness of 7–9 nm (modes 10–1,000) which is similar to that obtained with undoped coatings. High levels of dopant result in cracking of the inner mandrel during target assembly. Possible explanations for the observed cracking behavior will be discussed.

22889 (UCRL-JC–117397) **The National Ignition Facility Project.** Paisner, J.A.; Campbell, E.M.; Hogan, W.J. Lawrence Livermore National Lab., CA (United States). 16 Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940630–57: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE95010923. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the National Ignition Facility is to achieve ignition and gain in ICF targets in the laboratory. The facility will be used for defense applications such as weapons physics and weapons effect testing, and for civilian applications such as fusion energy development and fundamental studies of matter at high temperatures and densities. This paper reviews the design, schedule and costs associated with the construction project.

22890 (UCRL-JC–117467) **National Ignition Facility environmental protection systems.** Mintz, J.M.; Reitz, T.C.; Tobin, M.T. Lawrence Livermore National Lab., CA (United States). Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940630–56: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE95010921. Source: OSTI; NTIS; INIS; GPO Dep.

The conceptual design of Environmental Protection Systems (EPS) for the National Ignition Facility (NIF) is described. These systems encompass tritium and activated debris handling, chamber, debris shield and general decontamination, neutron and gamma monitoring, and radioactive, hazardous and mixed waste handling. Key performance specifications met by EPS designs include limiting the tritium inventory to 300 Ci and total tritium release from NIF facilities to less than 10 Ci/yr. Total radiation doses attributable to NIF shall remain below 10 mrem/yr for any member of the general public and 500 mrem/yr for NIF staff. ALARA-based design features and operational procedures will, in most cases, result in much lower measured exposures. Waste minimization, improved cycle time and reduced exposures all result from the proposed CO2 robotic arm cleaning and decontamination system, while effective tritium control is achieved through a modern system design based on double containment and the proven detritiation technology.

22891 (UCRL-JC–117491) **Multiple-beam pulse shaping and preamplification.** Wilcox, R.B.; VanWonterghem, B.W.; Burkhart, S.C.; Davin, J.M. Lawrence Livermore National Lab., CA (United States). 9 Nov 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9411152–4: International Atomic Energy Agency (IAEA) technical committee meeting on drivers for inertial confinement fusion, Paris (France), 14-18 Nov 1994). Order Number DE95011738. Source: OSTI; NTIS; GPO Dep.

Glass fusion laser systems typically use a master oscillator-power amplifier (MOPA) architecture, where control of the optical pulse temporal and spatial parameters is accomplished mainly in the master oscillator and low power optics. The pulses from this low power "front end" are amplified in the power amplifier, which modifies the pulse shape temporally and spatially. Nonlinear frequency conversion crystals following the amplifier further change the pulse before it reaches the target. To effectively control the optical pulse on target for different types of experiments, and compensate for nonlinearity in the preceding optics, the front end system must be versatile enough to easily control many pulse parameters over a large range. The front end pulse generation system described in this article represents a new approach to this problem. The proposed National Ignition Facility (NIF) has 192 beamlines, each of which requires an input pulse of up to 12 Joules in around 4 ns equivalent square pulse length. Considerations of laser architecture for supplying each of these beamlines from a central oscillator system were crucial in the design of the front end. Previous lasers have used bulk optics to split a single oscillator signal and report beams to multiple amplifier chains. A key idea in the current design is to replace bulk optic transport with fibers, eliminating large opto-mechanical subsystems. Another important concept is convenient pulse forming using low voltage integrated optic modulators. The integrated optic and fiber optic concepts resulted in the current pulse generation designs for NEF. An important advantage is that each of the beamlines can have an independently controlled temporal pulse shape, which provides for precise balance of instantaneous power on target.

22892 (UCRL-JC–119004) **Absolute wavefront measurements of high-energy laser beams in the Beamlet Demonstration Project for the National Ignition Facility.** Salmon, J.T.; Bliss, E.S.; Kartz, M.W.; Van Wonterghem, B.M. Lawrence Livermore National Lab., CA (United States). Nov 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950540–10: 15. conference on lasers and electro-optics and 5th quantum electronics and laser science conference, Baltimore, MD (United States), 21-26 May 1995). Order Number DE95012224. Source: OSTI; NTIS; INIS; GPO Dep.

The authors measure the absolute wavefront of Beamlet output pulses and actively correct for slowly varying aberrations present when the power amplifiers are not fired. Provision is also made for active precompensation of pump-induced amplifier aberrations.

22893 (UCRL-JC–119390) **Fabrication and testing of gas filled targets for large scale plasma experiments on Nova.** Stone, G.F. (Lawrence Livermore National Lab., CA (United

States)); Spragge, M.; Wallace, R.J.; Rivers, C.J. Lawrence Livermore National Lab., CA (United States). 6 Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950291–2: 10. target fabrication specialists' meeting, Taos, NM (United States), 6-9 Feb 1995). Order Number DE95012471. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental campaign on the Nova laser was started in July 1993 to study one st of target conditions for the point design of the National Ignition Facility (NIF). The targets were specified to investigate the current NIF target conditions–a plasma of ~3 keV electron temperature and an electron density of ~1.0 E + 21 cm^{-3}. A gas cell target design was chosen to confine as gas of ~0.01 cm^3 in volume at ~ 1 atmosphere. This paper will describe the major steps and processes necessary in the fabrication, testing and delivery of these targets for shots on the Nova Laser at LLNL.

22894 (UCRL-JC–119533) **Feasibility of organo-beryllium target mandrels using organo-germanium PECVD as a surrogate.** Brusasco, R.M.; Dittrich, T.; Cook, R.C. Lawrence Livermore National Lab., CA (United States). 9 Mar 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950291–1: 10. target fabrication specialists' meeting, Taos, NM (United States), 6-9 Feb 1995). Order Number DE95011802. Source: OSTI; NTIS; INIS; GPO Dep.

Inertial Confinement Fusion capsules incorporating beryllium are becoming attractive for use in implosion experiments designed for modest energy gain. This paper explores the feasibility of chemical vapor deposition of organo-beryllium precursors to form coating materials of interest as ablators and fuel containers. Experiments were performed in a surrogate chemical system utilizing tetramethylgermane as the organometallic precursor. Coatings with up to 60 mole percent germanium were obtained. These coatings compare favorably with those previously reported in the literature and provide increasing confidence that a similar deposition process with an organo-beryllium precursor would be successful.

22895 (UCRL-JC–120517) **Optical pulse generation using fiber lasers and integrated optics.** Wilcox, R.B.; Browning, D.F.; Burkhart, S.C.; VanWonterghem, B.W. Lawrence Livermore National Lab., CA (United States). 27 Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506179–1: 1995 international conference on integrated optics and optical fibre communications, Tokyo (Japan), 26-30 Jun 1995). Order Number DE95011517. Source: OSTI; NTIS; INIS; GPO Dep.

We have demonstrated an optical pulse forming system using fiber and integrated optics, and have designed a multiple-output system for a proposed fusion laser facility. Our approach is an advancement over previous designs for fusion lasers, and an unusual application of fiber lasers and integrated optics.

22896 (UCRL-LR–105821-94-3) **Inertial confinement fusion quarterly report, April–June 1994. Volume 4, Number 3.** Shaw, M.J. (ed.). Lawrence Livermore National Lab., CA (United States). Jun 1994. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011970. Source: OSTI; NTIS; GPO Dep.

This issue of the ICF Quarterly contains six articles covering a wide range of activities within the Inertial Confinement Fusion (ICF) Program. It concentrates on target design; theoretical spectral analysis of ICF capsule surfaces; laser fusion experimental methods; and an alternative ICF design, based on ultrafast, ultrapowerful lasers. A key issue for the success of the ICF process is the hydrodynamic stability of the imploding capsule. There are two primary sources of instability growth in the ICF process: (1) asymmetries in the x-ray flux that drive the compression lead to asymmetric in the imploding surface; (2) imperfections on the capsule surface can grow into large perturbations, degrading the capsule performance. In recent years, a great deal of effort, both experimentally and theoretically, has been spent to enhance the Program's ability to measure, model, and minimize instability growth during an implosion. Four the articles in this issue discuss this subject.

22897 (UCRL-LR–105821-94-4) **Inertial confinement fusion quarterly report, July–September 1994. Volume 4, Number 4.** Honea, E. (ed.). Lawrence Livermore National Lab., CA (United States). Sep 1994. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011969. Source: OSTI; NTIS; GPO Dep.

The ICF Quarterly continues with six articles in this issue describing recent developments in the Inertial Confinement Fusion (ICF) Program at Lawrence Livermore National Laboratory. The topics include plasma characterization, production of millimeter scale-length plasmas for studying laser-plasma instabilities, hohlraum physics, three-dimensional hydrodynamic modeling, crystal growth, and laser-beam smoothing.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 21056

22898 (UCRL-ID–119305) **The metric system: An introduction.** Lumley, S.M. Lawrence Livermore National Lab., CA (United States). [1995]. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012107. Source: OSTI; NTIS; GPO Dep.

On July 13, 1992, Deputy Director Duane Sewell restated the Laboratory's policy on conversion to the metric system which was established in 1974. Sewell's memo announced the Laboratory's intention to continue metric conversion on a reasonable and cost effective basis. Copies of the 1974 and 1992 Administrative Memos are contained in the Appendix. There are three primary reasons behind the Laboratory's conversion to the metric system. First, Public Law 100-418, passed in 1988, states that by the end of fiscal year 1992 the Federal Government must begin using metric units in grants, procurements, and other business transactions. Second, on July 25, 1991, President George Bush signed Executive Order 12770 which urged Federal agencies to expedite conversion to metric units. Third, the contract between the University of California and the Department of Energy calls for the Laboratory to convert to the metric system. Thus, conversion to the metric system is a legal requirement and a contractual mandate with the University of California. Public Law 100-418 and Executive Order 12770 are discussed in more detail later in this section, but first they examine the reasons behind the nation's conversion to the metric system. The second part of this report is on applying the metric system.

9901 Management

Refer also to citation(s) 20624, 21008, 21341, 21378, 21388, 21412, 21428, 21429, 21507, 22254, 22495, 22949

22899 (ANL/CMT-ACL/CP–85835) **Development of the Integrated Performance Evaluation Program (IPEP) for the Department of Energy's Office of Environmental Management.** Lindahl, P. (Argonne National Lab., IL (United States)); Streets, E.; Bass, D.; Hensley, J.; Newberry, R.; Carter, M. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950495–2: 7. national technology information exchange workshop, Cincinnati, OH (United States), 18-20 Apr 1995). Order Number DE95012929. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory (ANL) and DOE's Radiological and Environmental Sciences Laboratory (RESL), Environmental Measurements Laboratory (EML), and Grand Junction Project office (GJPO) are collaborating with DOE's Office of Environmental Management (EM), Analytical Services Division (ASD, EM-263) and the Environmental Protection Agency (EPA) to develop an Integrated Performance Evaluation Program (IPEP). The purpose of the IPEP is to integrate information from existing PE programs with expanded QA activities to develop information about the quality of radiological, mixed waste, and hazardous environmental sample analyses provided by all laboratories supporting EM programs. The IPEP plans to utilize existing PE programs when available and appropriate for use by DOE; new PE programs will be developed only when no existing program meets DOEs needs. Interagency Agreements have been developed between EPA and DOE to allow DOE to use major existing PE programs developed by EPA. In addition, the DOE radiological Quality Assessment Program (QAP) administered by EML is being expanded for use in EM work. RESL and GJPO

are also developing the Mixed Waste Performance Evaluation Program (MAPEP) to provide radiological, inorganic, and organic analytes of interest to EM programs. The use of information from multiple PE programs will allow a more global assessment of an individual laboratory's performance, as well as providing a means of more fairly comparing laboratories' performances in a given analytical area. The EPEP will interact with other aspects of the ASD such as audit and methods development activities to provide an integrated system for assessment and improvement of data quality.

22900 (ANL/DIS/CP–84623) **Strategies for reconciling environmental goals, productivity improvement, and increased energy efficiency in the industrial sector: Analytic framework.** Boyd, G.A. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950223–2: 3. biennial energy efficiency and the global environment conference: industrial competitiveness and sustainability, Newport Beach, CA (United States), 8-9 Feb 1995). Order Number DE95012937. Source: OSTI; NTIS; GPO Dep.

The project is motivated by recommendations that were made by industry in a number of different forums: the Industry Workshop of the White House Conference on Climate Change, and more recently, industry consultations for EPAct Section 131(c) and Section 160(b). These recommendations were related to reconciling conflicts in environmental goals, productivity improvements and increased energy efficiency in the industrial sector.

22901 (ANL/EA/CP–85661) **Determining training needs from supervisors' assessment of staff proficiency in tasks and skills.** Young, C. (Argonne National Lab., IL (United States)); Hensley, J.; Lehr, J. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950216–144: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95012934. Source: OSTI; NTIS; GPO Dep.

To provide the basis for establishing training opportunities, this project investigated supervisors' views of three components of staff activities. The project established the tasks that staff perform, identified staffs level of effectiveness in performing these tasks, and investigated staffs level of proficiency in performing the skills underlying these tasks. Training opportunities were then determined in those areas where knowledge and skins could be improved for staff to perform their tasks more effectively. Staff currently perform their tasks sufficiently well. Furthermore, supervisors indicated that for the most part staff do perform the tasks they should perform. In carrying out these tasks, staff use primarily critical thinking, problem solving, and communication skills rather than discipline-specific skills. Although staff generally have working knowledge of most of these skills, additional training in critical thinking and problem solving, program and project management techniques, and communications is appropriate to further improve the organizations effectiveness.

22902 (CEA-SFID–2.b) **Memento on the period of instruction reception of safety engineers 1995.** Faure, J.; Maggioli, P. CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Section Formation Informatique Documentation. Jan 1995. 144p. (In French). Order Number DE95632492. Source: OSTI; NTIS (US Sales Only); INIS.

In this report on the instruction period for safety engineers are given the calendar for 1995, a brief curriculum vitae of the interveners and the leading ideas of their presentation.

22903 (CONF-950669–2) **Managing electronic records: A guideline.** Stewart, J. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From DOE records management conference: El Camino Real to the year 2000; Albuquerque, NM (United States); 27-30 Jun 1995. Order Number DE95013973. Source: OSTI; NTIS; GPO Dep.

A committee at Martin Marietta Energy Systems (MMES) has drafted a guideline to assist offices in the management of electronic records. This paper will address the activities surrounding its creating. The guideline is for use by creators, users, and custodians of any type of electronic information. The guideline supports and supplements requirements from DOE and the National Archives and Records Administration (NARA), other internal processes such as system reviews, and the comprehensive records management program. While an in-house publication, it could prove useful to other organizations implementing an electronic records management program.

22904 (DOE/EM–0239) **Cost quality management assessment for the Savannah River Site. Final report.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Office of Engineering and Cost Management. Jun 1995. 130p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014141. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Engineering and Cost Management (EM-24) conducted the Round I Cost Quality Management Assessment at the Savannah River Operations Office on Feb. 3-14, 1992. Since the Round I CQMA, the mission of DOE-SR changed from production of nuclear materials (T_2, Pu) to environmental restoration. Transition of DOE-SR from defense programs to environmental management started in Jan. 1995. The Round II CQMA at the Savannah River Site, conducted April 23-May 5, 1995, reviewed DOE-SR's cost and cost-related management practices against performance objectives and criteria. SRS has made progress in cost-management practices since Round I and is adopting a more cost-conscious culture.

22905 (FEMP–2425) **The Fernald wet records recovery project: A case history.** Sterling, H.J. (Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)); Devir, B.R.; Hawley, R.A.; Freesmeyer, M.T. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). 7 Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC24-92OR21972. (CONF-950669–1: DOE records management conference: El Camino Real to the year 2000, Albuquerque, NM (United States), 27-30 Jun 1995). Order Number DE95013795. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses a project performed to recover wet records discovered in January 1995 at the Fernald Environmental Management Project (FEMP). This paper discusses the emergency and record recovery phases of the project, the technical options considered for records recovery, and special measures which were required due to radiological contamination of the records. Also, the root causes and lessons learned from the incident, and path forward for future records management operations at Fernald, are discussed.

22906 (SAND–89-0217-Rev.5) **Acronyms, initialisms and abbreviations. Revision 5.** Tolman, B.J. (comp.). Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 167p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010679. Source: OSTI; NTIS; GPO Dep.

This document is a list of utilized acronyms, initialisms, and abbreviations frequently utilized, or derived from, personnel, particularly scientific personnel and engineers, working on government contracts or as government employees.

22907 (UCRL-ID–120595) **Advanced manufacturing: Technology and international competitiveness.** Tesar, A. Lawrence Livermore National Lab., CA (United States). Feb 1995. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014508. Source: OSTI; NTIS; GPO Dep.

Dramatic changes in the competitiveness of German and Japanese manufacturing have been most evident since 1988. All three countries are now facing similar challenges, and these challenges are clearly observed in human capital issues. Our comparison of human capital issues in German, Japanese, and US manufacturing leads us to the following key judgments: Manufacturing workforces are undergoing significant changes due to advanced manufacturing technologies. As companies are forced to develop and apply these technologies, the constituency of the manufacturing workforce (especially educational requirements, contingent labor, job content, and continuing knowledge development) is being dramatically and irreversibly altered. The new workforce requirements which result

due to advanced manufacturing require a higher level of worker sophistication and responsibility.

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22908 (ANL/ECT/CP–85500) **Kerberos authentication: The security answer for unsecured networks.** Engert, D.E. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505223–1: 17. DOE Computer Security Group training conference, Germantown, MD (United States), 8-11 May 1995). Order Number DE95013434. Source: OSTI; NTIS; GPO Dep.

Traditional authentication schemes do not properly address the problems encountered with today's unsecured networks. Kerbmm developed by MIT, on the other hand is designed to operate in an open unsecured network, yet provide good authentication and security including encrypted session traffic. Basic Kerberos principles as well as experiences of the ESnet Authentication Pilot Project with Cross Realm. Authentication between four National Laboratories will also be described.

22909 (ANL/MCS/CP–83746) **A data transfer library for communicating data-parallel tasks.** Avalani, B. (CIS/CSE, Syracuse Univ., Syracuse, NY (United States)); Choudhary, A.; Krishnaiyer, R.; Foster, I.; Xu, M. Argonne National Lab., IL (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Contract CCR-8809615; Contract DABT63-91-C-0028; Award CCR-93578 (CONF-9502101–1: Frontiers 95: a workshop on future directions of massively parallel processing, McLean, VA (United States), 6-9 Feb 1995). Order Number DE95012288. Source: OSTI; NTIS; GPO Dep.

Many computations can be structured as sets of communicating data-parallel tasks. Individual tasks may be coded in HPF, pcC+, etc.; periodically, tasks exchange distributed arrays via channel, virtual file, message-passing, etc., operations. The implementation of these operations is complicated by the fact that the processes engaging in the communication may execute on different numbers of processors and may have different distributions for communicated data structures. In addition, they may be connected by different sorts of networks. In this paper, we describe a Communicating Data-parallel Tasks (CDT) library that we are developing for constructing applications of this sort. We outline the techniques used to implement this library and describe a range of data transfer strategies and several algorithms based on these strategies. We also present performance results for several algorithms. The CDT library is being used as a compiler target for an HPF compiler augmented with FM extensions.

22910 (ANL/MCS/CP–84608) **On the influence of the partitioning schemes on the efficiency of overlapping domain decomposition methods.** Ciarlet, P. Jr. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)); Lamour, F.; Smith, B.F. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. NSF Contract ASC9201266; Army Research Office Contract DAAL0391G (CONF-9502101–3: Frontiers 95: a workshop on future directions of massively parallel processing, McLean, VA (United States), 6-9 Feb 1995). Order Number DE95012935. Source: OSTI; NTIS; GPO Dep.

One level overlapping Schwarz domain decomposition preconditioners can be viewed as a generalization of block Jacobi preconditioning. The effect of the number of blocks and the amount of overlapping between blocks on the convergence rate is well understood. This paper considers the related issue of the effect of the scheme used to partition the matrix into blocks on the convergence rate of the preconditioned iterative method. Numerical results for Laplace and linear elasticity problems in two and three dimensions are presented. The tentative conclusion is that using overlap tends to decrease the differences between the rates of convergence for different partitioning schemes.

22911 (ANL/MCS/CP–86364) **On the automatic differentiation of computer programs.** Bischof, C.H. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-31109-ENG-38. Cooperative Agreement CCR-9120008; Purchase Order L25935D. (CONF-950317–1: Symposium on optimization of mechanical systems, Stuttgart (Germany), 26-31 Mar 1995). Order Number DE95012276. Source: OSTI; NTIS; GPO Dep.

Automatic differentiation (AD) is a methodology for developing sensitivity-enhanced versions of arbitrary computer programs. In this paper, we provide some background information on AD and address some frequently asked questions. We introduce the ADIFOR and ADIC tools for the automatic differentiation of Fortran 77 and ANSI-C programs, respectively, and give an example of applying ADIFOR in the context of the optimization of multibody systems.

22912 (ANL/MCS/CP–86474) **Scalable Unix tools on parallel processors.** Gropp, W.; Lusk, E. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9405100–13: Scalable high performance computing conference, Knoxville, TN (United States), 23 May 1994). Order Number DE95012292. Source: OSTI; NTIS; GPO Dep.

The introduction of parallel processors that run a separate copy of Unix on each process has introduced new problems in managing the user's environment. This paper discusses some generalizations of common Unix commands for managing files (e.g. ls) and processes (e.g. ps) that are convenient and scalable. These basic tools, just like their Unix counterparts, are text-based. We also discuss a way to use these with a graphical user interface (GUI). Some notes on the implementation are provided. Prototypes of these commands are publicly available.

22913 (ANL/MCS-TM–150-Rev.) **The MINPACK-2 test problem collection.** Averick, B.M. (Minnesota Univ., Minneapolis, MN (United States). Army High Performance Computing Research Center); Carter, R.G.; Xue, Guo-Liang; More, J.J. Argonne National Lab., IL (United States). Jun 1992. 69p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95013766. Source: OSTI; NTIS; GPO Dep.

Optimization software has often been developed without any specific application in mind. This generic approach has worked well in many cases, but as we seek the solution of larger and more complex optimization problems on high-performance computers, the development of optimization software should take into account specific optimization problems that arise in a wide range of applications. This observation was the motivation for the development of the MINPACK-2 test problem collection. Each of the problems in this collection comes from a real application and is representative of other commonly encountered problems. There are problems from such diverse fields as fluid dynamics, medicine, elasticity, combustion, molecular conformation, nondestructive testing, chemical kinetics, lubrication, and superconductivity.

22914 (ANL/MCS/TM–201) **Users guide to the Argonne SP scheduling system.** Lifka, D.A. (Argonne National Lab., IL (United States)); Henderson, M.W.; Rayl, K. Argonne National Lab., IL (United States). May 1995. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95012987. Source: OSTI; NTIS; GPO Dep.

During the past five years scientists discovered that modern UNIX workstations connected with ethernet and fiber networks could provide enough computational performance to compete with the supercomputers of the day. As this concept became increasingly popular, the need for distributed queuing and scheduling systems became apparent. Today, supercomputers, such as Argonne National Laboratory's IBM SP system, can provide more CPU and networking speed than can be obtained from these networks of workstations. These modern supercomputers look like clusters of workstations, however, so developers felt that the scheduling systems that were previously used on clusters of workstations should still apply. After trying to apply some of these scheduling systems to Argonne's SP environment, it became obvious that these two computer environments have very different scheduling needs. Recognizing this need and realizing that no one has addressed it, we developed a new scheduling system. The approach taken in creating this system was unique in that user input and interaction were encouraged throughout the development process. Thus, a scheduler was built that actually worked the way the users wanted it to work. This document serves a dual purpose. It is both a user's guide and an administrator's guide for the ANL SP scheduling system. Look for revisions to this guide that will be appearing.

22915 (ANL/MCS/TM–206) **Users manual for doctext: Producing documentation from C source code.** Gropp, W. Argonne National Lab., IL (United States). Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95012943. Source: OSTI; NTIS; GPO Dep.

One of the major problems that software library writers face, particularly in a research environment, is the generation of documentation. Producing good, professional-quality documentation is tedious and time consuming. Often, no documentation is produced. For many users, however, much of the need for documentation may be satisfied by a brief description of the purpose and use of the routines and their arguments. Even for more complete, hand-generated documentation, this information provides a convenient starting point. We describe here a tool that may be used to generate documentation about programs written in the C language. It uses a structured comment convention that preserves the original C source code and does not require any additional files. The markup language is designed to be an almost invisible structured comment in the C source code, retaining readability in the original source. Documentation in a form suitable for the Unix man program (nroff), LaTeX, and the World Wide Web can be produced.

22916 (BNL–61505) **Summer Research Internship Program (FY94) Brookhaven National Laboratory.** Toler, L.T.; Indusi, J.P. Brookhaven National Lab., Upton, NY (United States). 1 Feb 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9502100–1: Workshop on the Summer Research Intership Program, Newport News, VA (United States), 16-17 Feb 1995). Order Number DE95008868. Source: OSTI; NTIS; GPO Dep.

The Summer Research Internship Program is a new program that allows high school teachers to participate and assist scientific staff at national laboratories in specific research assignments. This participation allows the high school teachers to become familiar with new technology and have "hands-on" experience with experiments and equipment which utilize both mathematics and science skills. Teachers also have the opportunity to advance their new and well-developed software. This enlightenment and experience is brought back into their schools and classrooms in the hopes that their peers and students will realize the excitement that knowledge and education in the areas of mathematics and science can bring. The Safeguards, Safety and Nonproliferation Division of the Department of Advanced Technology at Brookhaven National Laboratory utilized five high school teachers during FY94 in various projects. The project assignments and internship activities are outlined in this paper.

22917 (CEA-CONF–11774) **How many collisions for a neutron in a Tripoli non analogue simulation?.** Morillon, B.; Both, J.P.; Derriennic, H.; Diop, C.M.; Nimal, J.C. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1994. 7p. (CONF-940424–: 8. international conference on radiation shielding, Arlington, TX (United States), 24-27 Apr 1994). Order Number DE95632488. Source: OSTI; NTIS (US Sales Only); INIS.

In an analogue simulation, flux, current, etc. are estimated, and for each particle, the number of shocks is counted and the distance covered is calculated. When the attenuation is significant the natural simulation remains inefficient: it becomes necessary to use variance reduction methods in which the solution of the adjoint transport equation is essential; this is the non analogue simulation. This study analyzes the average behaviour during analogue and non analogue simulations for one-energy group, one dimension transport problem with isotropic shocks. Comparisons between these simulations give hints about why an optimal simulation exists. The penetration problem and the results of the analogue simulation are first presented; then the non analogue simulations are run with path stretching and angular biasing of the scattering kernel, the most important biasing techniques of the Monte Carlo transport TRIPOLI code. (from authors) 11 figs., 3 tabs., 3 refs.

22918 (CEA-CONF–11826) **A finite volume element method for the Navier-Stokes equations.** Emonot, Ph. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Thermohydraulique et de Physique); Villand, M.; Baranger, J.; Maitre, J.F.; Bourg, A. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Thermohydraulique et de Physique. 1993. 8p. (CONF-9309333–: 5. international symposium on refined flow modelling and turbulence measurements, Paris (France), 7-10 Sep 1993). Order Number DE95631666. Source: OSTI; NTIS (US Sales Only); INIS.

Finite volume elements methods are introduced with application to the Poisson's equation and the Stokes problem; errors are estimated and theorems are derived. Then the method is applied to the Crouzeix Raviart element and extended in order to solve the full Navier-Stokes equation. Numerical results on the Vahl Davis test case are given. 5 figs., 1 tab., 8 refs.

22919 (CEA-CONF–11843) **The adjoint sensitivity method, a contribution to the code uncertainty evaluation.** Ounsy, A.; Crecy, F. de; Brun, B. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Thermohydraulique et de Physique. 1993. 7p. (CONF-930621–: American Society of Mechanical Engineers (ASME) fluids engineering conference, Washington, DC (United States), 20-24 Jun 1993). Order Number DE95631675. Source: OSTI; NTIS (US Sales Only); INIS.

The application of the ASM (Adjoint Sensitivity Method) to thermohydraulic codes, is examined. The advantage of the method is to be very few CPU time consuming in comparison with usual approach requiring one complete code run per sensitivity determination. The mathematical aspects of the problem are first described, and the applicability of the method of the functional-type response of a thermalhydraulic model is demonstrated. On a simple example of non linear hyperbolic equation (Burgers equation) the problem has been analyzed. It is shown that the formalism used in the literature treating this subject is not appropriate. A new mathematical formalism circumventing the problem is proposed. For the discretized form of the problem, two methods are possible: the Continuous ASM and the Discrete ASM. The equivalence of both methods is demonstrated; nevertheless only the DASM constitutes a practical solution for thermalhydraulic codes. The application of the DASM to the thermalhydraulic safety code CATHARE is then presented for two examples. They demonstrate that ASM constitutes an efficient tool for the analysis of code sensitivity. (authors) 7 figs., 5 tabs., 8 refs.

22920 (CONF-930014–1) **An object oriented design for high performance linear algebra on distributed memory architectures.** Dongarra, J.J. (Oak Ridge National Lab., TN (United States)); Walker, D.W.; Pozo, R. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Contract DAAL03-91-C-0047. From 1993 objected-oriented numerics conference; Snowbird, CO (United States); 1993. Order Number DE95012887. Source: OSTI; NTIS; GPO Dep.

We describe the design of ScaLAPACK++, an object oriented C++ library for implementing linear algebra computations on distributed memory multicomputers. This package, when complete, will support distributed dense, banded, sparse matrix operations for symmetric, positive-definite, and non-symmetric cases. In ScaLAPACK++ we have employed object oriented design methods to enchance scalability, portability, flexibility, and ease-of-use. We illustrate some of these points by describing the implementation of a right-looking LU factorization for dense systems in ScaLAPACK++.

22921 (CONF-930331–16) **LAPACK for distributed memory architectures: The next generation.** Demmel, J. (California Univ., Berkeley, CA (United States). Computer Science Div.); Dongarra, J.; van de Geijn, R.; Walker, D. Oak Ridge National Lab., TN (United States). 23 Jan 1995. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement CCR-8809615. From 6. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing; Norfolk, VA (United States); 21-24 Mar 1993. Order Number DE95012867. Source: OSTI; NTIS; GPO Dep.

We report the progress of an ongoing project that investigates the reusability of LAPACK code for distributed memory MIMD architectures. Major recent revisions include the adoption of a two-dimensional data mapping. This change enhances performance, scalability, and flexibility of the algorithms. Performance results from the Intel iPSC/860 and Intel Touchstone Delta systems are included.

22922 (CONF-9307220–1) **Modeling, mesh generation and adaptive numerical methods for partial differential equations: IMA summer program. Final report, April 1, 1993–March 31, 1994.** Friedman, A.; Miller, W. Jr. Minnesota Univ., Minneapolis, MN (United States). Inst. for Mathematics and Its Applications. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER25156. From Modeling, mesh generation and adaptive numerical methods for partial differential equations program; Minneapolis, MN (United States); 6-23 Jul 1993. Order Number DE95011540. Source: OSTI; NTIS; GPO Dep.

The program was divided into segments: (Week 1) geometric modeling and mesh generation (Weeks 2 and 3) error estimation and adaptive strategies. Participants in the program came from a wide variety of disciplines dealing with remarkably analogous problems in this area. Ideas were exchanged and interdisciplinary collaboration was initiated in informal contexts as well as in the talks and question periods. In the talks, a number of algorithms were described along with specific applications to problems of great current interest in various scientific and engineering disciplines. In this emerging field, participants developed criteria for evaluation of algorithms and established guidelines for selection of algorithms appropriate to any specific problem. Special features of a problem may include curved surfaces, complicated boundaries, evolving interfaces (such as occur in coating flows), and/or criticality of error estimation.

22923 (CONF-940451–2) **The design of scalable software libraries for distributed memory concurrent computers.** Choi, J. (Oak Ridge National Lab., TN (United States). Mathematical Sciences Section); Walker, D.W.; Dongarra, J.J. Oak Ridge National Lab., TN (United States). [1994]. 9p. Sponsored by Department of Defense, Washington, DC (United States);USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Contract DAAL03-91-C-0047. From Parallel processing symposium; Cancun (Mexico); 26-29 Apr 1994. Order Number DE95012891. Source: OSTI; NTIS; GPO Dep.

This paper describes the design of ScaLAPACK, a scalable software library for performing dense and banded linear algebra computations on distributed memory concurrent computers. The specification of the data distribution has important consequences for interprocessor communication and load balance, and hence is a major factor in determining performance and scalability of the library routines. The block cyclic data distribution is adopted as a simple, yet general-purpose, way of decomposing block-partitioned matrices. Distributed memory versions of the Level 3 BLAS provide an easy and convenient way of implementing the ScaLAPACK routines.

22924 (CONF-9405100–14) **PB-BLAS: A set of parallel block basic linear algebra subprograms.** Choi, Jaeyoung (Tennessee Univ., Knoxville, TN (United States). Dept. of Computer Science); Dongarra, J.; Walker, D.W. Oak Ridge National Lab., TN (United States). [1994]. 31p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. DAAL03-91-C-0047. From Scalable high performance computing conference; Knoxville, TN (United States); 23 May 1994. Order Number DE95012872. Source: OSTI; NTIS; GPO Dep.

We propose a new library of routines for performing dense linear algebra computations on block-partitioned matrices. The routines are referred to as the Block Basic Linear Algebra Subprograms, and their use is restricted to computations in which one or more of the matrices involved consists of a single row or column of blocks, and in which no more than one of the matrices consists of an unrestricted two-dimensional array of blocks. The functionality of the block BLAS routines can also be provided by Level 2 and 3 BLAS routines. However, for Non-Uniform Memory Access machines the use of the block BLAS permit certain optimizations in memory access to be taken advantage of. This is particularly true for distributed memory machines, for which the block BLAS are referred to as the Parallel Block Basic Linear Algebra Subprograms (PB-BLAS). The PB-BLAS are the main focus of this paper, and for a block-cyclic data distribution, a single row or column of blocks lies in a single row or column of the processor template. The PB-BLAS consist of calls to the sequential BLAS for local computations, and calls to the BLACS for communication. The PB-BLAS are the building blocks for implementing ScaLAPACK, the distributed-memory version of LAPACK, and provide the same ease-of-use and portability for ScaLAPACK that the BLAS provide for LAPACK. The PB-BLAS consists of all nine Level 3 BLAS routines, four of the Level-2 BLAS routines, and 2 auxiliary transpose routines. The PB-BLAS are currently available for all numeric data types, i.e., single and double precision real and complex.

22925 (CONF-9409351–1) **QMR methods in computational fluid dynamics.** Nachtigal, N.M.; Semeraro, B.D. Oak Ridge National Lab., TN (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International workshop on solution techniques for large-scale computational fluid dynamics (CFD) problems; Montreal (Canada); 26-28 Sep 1994. Order Number DE95012889. Source: OSTI; NTIS; GPO Dep.

We examine the application of QMR methods to the solution of linear systems of equations arising from the use of implicit solution methods in computational fluid dynamics. We will deal with implicit finite difference schemes for solving the Euler equations. These schemes may arise from the implicit treatment of the time dependent equations or from the use of Newton's method for the solution of the steady state equations. In both situations it is necessary to solve a large sparse nonsymmetric linear system of equations at each iteration. We will examine the effectiveness of QMR in the solution of these systems. W e compare the resulting methods to methods which rely on some other simplifying technique to solve the linear systems. Our goal is to show that the QMR method is a viable alternative to the more ad-hoc schemes for solving implicit computational fluid dynamics problems.

22926 (CONF-9505195–4) **Assurances associated with Monte Carlo code results.** Hollenbach, D.F.; Petrie, L.M. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nuclear criticality technology and safety project (NCTSP) annual meeting; San Diego, CA (United States); 17 May 1995. Order Number DE95013218. Source: OSTI; NTIS; GPO Dep.

All Monte Carlo computer codes have an uncertainty associated with the final result. This uncertainty (or standard deviation) is due to the sampling method inherent within the Monte Carlo technique. The basic assumptions required for the final result and uncertainty to be valid are (1) the random numbers used are truly random, (2) there is no correlation between histories, (3) the number of histories used is sufficient to represent the problem, and (4) the entire problem is adequately sampled. The first two assumptions are an integral are strongly dependent on how a problem is set up and the

number of histories processed. These are items the user has direct control over. This paper examines six aspects of the KENO Monte Carlo code that affect the above-mentioned four assumptions.

22927 (DOE/ER/53266–50) **An object-oriented decomposition of the adaptive-hp finite element method.** Wiley, J.C. Texas Univ., Austin, TX (United States). Fusion Research Center. 13 Dec 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER53266. (FRCR–454; CONF-9404121–4: 2. Conference on object-oriented numerics (OONSKI '94), Sun River, OR (United States), 24 Apr 1994). Order Number DE95012142. Source: OSTI; NTIS; GPO Dep.

Adaptive-hp methods are those which use a refinement control strategy driven by a local error estimate to locally modify the element size, h, and polynomial order, p. The result is an unstructured mesh in which each node may be associated with a different polynomial order and which generally require complex data structures to implement. Object-oriented design strategies and languages which support them, e.g., C++, help control the complexity of these methods. Here an overview of the major classes and class structure of an adaptive-hp finite element code is described. The essential finite element structure is described in terms of four areas of computation each with its own dynamic characteristics. Implications of converting the code for a distributed-memory parallel environment are also discussed.

22928 (ESTSC–000734MLTPL01) **SPI/U3.2. Security Profile Inspector for UNIX Systems.** Bartoletti, A. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Aug 1994. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Source: ESTSC.

Description: MLT-PLTFM; UNIX; Standard C (95%), Bourne Shell Script (5%); 1 Mag Tape. For security reasons, many data paths are fixed in the code during the installation (compiling) process. Therefore, SPI must be separately installed on each platform on which it is to be run. SPI output reports and cdt database archives may accumulate. These files should be purged manually as appropriate to the need and available disk space.

SPI/U3.2 consists of five tools used to assess and report the security posture of computers running the UNIX operating system. The tools are: Access Control Test: A rule-based system which identifies sequential dependencies in UNIX access controls. Binary Authentication Tool: Evaluates the release status of system binaries by comparing a crypto-checksum to provide table entries. Change Detection Tool: Maintains and applies a snapshot of critical system files and attributes for purposes of change detection. Configuration Query Language: Accepts CQL-based scripts (provided) to evaluate queries over the status of system files, configuration of services and many other elements of UNIX system security. Password Security Inspector: Tests for weak or aged passwords. The tools are packaged with a forms-based user interface providing on-line context-sensistive help, job scheduling, parameter management and output report management utilities. Tools may be run independent of the UI.

22929 (ESTSC–000788MLTPL00) **DYNAMO. Molecular Dynamics and Energy Minimization Based on Embedded Atom Method.** Folies, S.M. (Sandia National Labs., Livermore, CA (United States)); Daw, M.S. Sandia Labs., Livermore, CA (United States). 1 Feb 1992. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: MLT-PLTFM; Version provided was compiled an-FORTRAN 77 with Namelist input extensions.; 1 QIC Cartridge. No additional software libraries are required.

This program performs atomic scale computer simulations of the structure and dynamics of metallic system using energetices based on the Embedded Atom Method. The program performs two types of calculations. First, it performs local energy minimization of all atomic positions to determine ground state and saddle point energies and structures. Second, it performs molecular dynamics simulations to determine thermodynamics or miscroscopic dynamics of the system. In both cases, various constraints can be applied to the system. The volume of the system can be varied automatically to achieve any desired external pressure. The temperature in molecular dynamics simulations can be controlled by a variety of methods. Further, the temperature control can be applied either to the entire system or just a subset of the atoms that would act as a thermal source/sink. The motion of one or more of the atoms can be constrained to either simulate the effects of bulk boundary conditions or to facilitate the determination of saddle point configurations. The simulations are performed with periodic boundary conditions.

22930 (ESTSC–000814X309000) **XDELAY. FPGA ROM Code for Very Large FIFO Control.** Pratt, T.J. (Sandia National Labs., Albuquerque, NM (United States)). Sandia National Labs., Albuquerque, NM (United States). 1 Jan 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Source: ESTSC.

Description: XILINX 3090; The program was produced using DMCS86 ROM code and XILINX's configuration language.; 1 QIC Cartridge. .drw=drawing page, .xnf=Xilinx Netlist file, .dly=Internal delay, .cst=Pin constants, .bit=Configuration File, .mcs=Prom file.

The code is used to program a Field Programmable Gate Array (FPGA) controls a 4 megabit FIFO so that a set delay from input to output is maintained. The FPGA is also capable of inserting errors into the data flow in a controlled manner.

22931 (ESTSC–000815SPARC00) **FASTHELP. Integrated Circuit Failure Analysis Hypertext Help System.** Henderson, C. (Sandia National Labs., Albuquerque, NM (United States)); Barton, D.; Campbell, A.; Cole, E.; Mikawa, R.E.; Peterson, K.A.; Rife, J.L.; Soden, J.M. Sandia National Labs., Albuquerque, NM (United States). 30 Sep 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Source: ESTSC.

Description: SUN SPARC; SUN OS 4.1.3, Solaris2.X; Hypertext Markup Language (HTML); 1 Mag Tape. In order to run this package, the user will need an HTML browser (e.g. Mosaic, Netscape, etc.). The user will also need an image viewer such as xv and a movie player such as mpeg play.

This software assists a failure analyst performing failure analysis on integrated circuits. The software can also be used to train inexperienced failure analysts. The software also provides a method for storing information and making it easily available to experienced failure analysts.

22932 (ESTSC–000823MLTPL00) **PGP SOLVER. Solver for Power and Ground Plane Parasitic Inductance Mesh.** Aranha, M. (Lawrence Berkely National Labs., CA (United States)); Royer, S. Lawrence Berkeley Lab., CA (United States). 1 Feb 1995. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Source: ESTSC.

Description: MLT-PLTFM; PGP-Solver can be run on any UNIC; 1 3.5 Diskette.

Printed Circuit Boards, Multichip Modules and other such electronic assemblies typically have two or more conductive interconnect layers or planes separated by some dielectric medium for the purpose of routing connections to power and ground pins respectively. The electrical parasitics, inherent in and between the planes, can be significant. To model these effects, the planes can be represented by a complex mesh of coupled inductive and resistive elements. This allows one to calculate the complex impedence of these parasitic elements so that power and ground pins and associated routing could be optimally positioned. OEA International Inc. has developed software which by spatial analysis using finite-differences techniques produces a large netlist of these parasitic elements. Traditional circuit analysis tools such as SPICE circuit simulators are prohibitively slow in analyzing the netlist. PGP-Solver is a practical alternative, producing an analytical solution for the mesh of complex impedences represented in the netlist, in an order of magnitude less computing time.

22933 (ESTSC–000830MLTPL00) **XDAMP. Experimental Time-Dependent Data Analysis, Manipulation, Visualization GUI.** Ballard, W.P. (Sandia National Labs., Albuquerque, NM (United States)). Sandia National Labs., Albuquerque, NM (United States). 1 Apr 1995. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Source: ESTSC.

Description: MLT-PLTFM; Determined by IDL relase. IDL muX-DAMP is written entirely as a macro using the IDL Language to

allow portability,; 1 3.5 Diskette. The following file naming conventions are used: *.pro for IDL procedures, *.cmn for IDL common blocks, *.hdf for hierarchical data format files, xdamp.out is the output file, xdamp.ss is a spreadhseet importable file automatically generated by some commands, manual.ps is the PostScript manual file included in the distribution, *dcf is a xdamp macro command file, ASCII data outut files have the default extension .asc. The distriibution contains an AAREADME.TXT file that explains where to install the software using the rar command and how to print out the manual.

XDAMP is a graphical user interface (GUI) designed to allow the user to manipulate two-dimensional waveforms (data vs. time) that typically are generated during transient response experiments. A typical single data set from these facilities may generate more than 100 time-dependent waveforms. XDAMP can manipulate waveforms both in time and in amplitude. Typical operations are: time shifting, truncating before or after a specific time, adding, multiplying, integrating, and averaging. The software automatically maintains an audit trail for operations performed on each waveform. Annotation can be added to the overall file so that the data set contains full documentation. PostScript printing graphics and annotation is supported. Data are saved using the Hierarchical Data Format (HDF) from the National Center for Supercomputing Applications.

22934 (ESTSC–000835MLTPL00) **CORD-2. Core Design Applications.** Trkov, A. (Josef Stefan Institute, Ljubljana (Slovenia)). OECD Nuclear Energy Agency, 75 - Paris (France). 10 Jul 1994. Sponsored by National Endowment for the Arts, Washington, DC (United States). Source: ESTSC.

Description: MLT-PLTFM; Machine dependent; FORTRAN77; 2 3.5 Diskettes. To execute a sequence of codes as necessary for a realistic calculation, the use of job control language is inevitable, but it has been kept to a minimum for better code portability. Appropriate procedures are provided for VAX/VMS and PC/DOS systems. These may serve as examples to the user, to make adjustments for his specific requirements or implementation on other operating systems.

CORD-2 is intended for core desigh applications of pressurized water reactors. The main objective was to assemble a core design system which could be used for simple calculations (such as frequently required for fuel management) as well as for accurate calculations (for example, core design after refueling).

22935 (ESTSC–000847MLTPL00) **PDASAC. Partial Differential Algebraic Sensitivity Analysis Code.** Caracotsios, M. (Amoco Chemical Company, Naperville, IL (United States)); Stewart, W.E. Wisconsin Univ., Madison, WI (United States). Dept. of Chemical Engineering. 1 Feb 1995. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13291. Source: ESTSC.

Description: MLT-PLTFM; PDASAC is in use on a wide varieWritten in Fortran and confroms largely to the Fortran 77 standard.; 1 3.5 Diskette. All floating-point numbers are expresssed in double precision. The Filename.FOR on the diskette denotes a Fortan source file, and Filename.DTA denotes an output data file. The .FOR files, when compiled and linked, suffice for execution of the four test problems given in the users' manual, APPENDIX C. The .DTA files correspond to the printed outputs of the four examples, given in Appendix C. These results were computed on a VAXstation 3200.

PDASAC solves stiff, nonlinear initial-boundary-value in a timelike dimension t and a space dimension x. Plane, circular cylindrical or spherical boundaries can be handled. Mixed-order systems of partial differential and algebraic equations can be analyzed with members of order or 0 or 1 in t, 0,1 or 2 in x. Parametric sensitivities of the calculated states are compted simultaneously on request, via the Jacobian of the state equations. Initial and boundary conditions are efficiently reconciled. Local error control (in the max-norm or the 2-norm) is provided for the state vector and can include the parametric sensitivites if desired.

22936 (ESTSC–001021U110000) **CPDREV. Spare Parts Inventory Control System.** Morgenthaler, A.C. (Rockwell Hanford Operations, Richland, WA (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). 1 Feb 1979. Sponsored by USDOE, Washington, DC (United States). (NESC–947). Source: ESTSC.

Description: UNIVAC1100; SCOPE 3.4.4 (CDC6600;CYBER74); NFORTRAN (99%) and Assembly language (1%); 1 Mag Tape. Both machine versions assume that memory has been preset to zero prior to execution. THE CDC6600 version executes only on CDC systems containing the CYBER Record Manager; several calls are made to record manager routines within the program.

CPDREV was developed to determine proper stock levels for an inventory of process spare parts. The program determines the amount of material to buy, and when it should be bought. CPDREV can compute an implied risk from a prespecified penalty cost, or conversely, the implied penalty cost from a prespecified risk level. The frequency of reordering is computed to provide a basis for distributing the projected workload among buyers and expeditors and to avoid an overstocked inventory. CPDREV is designed to assist maintenance managers in preparing spare parts purchase recommendations.

22937 (ESTSC–001023SPARC00) **MTPOT. MTPOT is the Linkage Code Between Teapot and ZLIB.** Sun, N. (Superconducting Super Collider Laboratory, Waxahachie, TX, (United States)); Yang, Y.T.; Pilat, F.; Bourianoff, G. Fermi National Accelerator Lab., Batavia, IL (United States). 1 Feb 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: SUN SPARC; SunOS, Unix; Fortran; 1 Mag Tape. File format given in SSCL-preprint-474 included in the documents.

MTpot can perform both element-by-element tracking and truncated Tylor map extraction and tracking.

22938 (ESTSC–001025SUN0000) **TRANSFER. Beam Transfer Simulation Program.** Yao, C.Y. (Superconducting Super Collider Laboratory, Waxahachie, TX, (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). 1 Dec 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: SUN; SunOS, Unix; C (69%), Fortran (31%); 1 Mag Tape. Make executable file using 'make<CR>', 'icon' subdirectory contains icon files and should not be deleted.

Beam Transfer simulation package with GUI using X11/Motif.

22939 (ESTSC–001026SGIIP00) **BDL. Beam Dynamics Laboratory.** Cole, B. (Superconducting Super Collider Laboratory, Waxahachie, Tx, (United States)); Singleton, L. Fermi National Accelerator Lab., Batavia, IL (United States). 1 May 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: SILICON GRAPHIC; GL; C; 1 Mag Tape.

Simple model of an accelerator as it is running can be interactively manipulated to observe the effects of the manipulations of particle motion. The system can be used to demonstrte effects such as decoherence, slow-extraction, resonance islands, coupling resonance and synchro-betatron coupling.

22940 (ESTSC–001027SUN0000) **COOLWARM. Magnet Cooldown and Warmup Model.** Carcagno, R. H. (Superconducting Super Collider Laboratory, Waxahachie, TX (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). 1 Feb 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: SUN; Sun OS, VAX/VMS, MS-DOS, any thaFortran 77; 1 Mag Tape. For the Sun OS, type: f77 coolwarm.f heprop.f-0coolwarm. To run the program after the executable is created, type: coolwarm.

This program evaluates cooldown/warmup performance of an SSC magnet or magnet strings, But can be applied to any other iron coldmass which is cooled or warmed by helium.

22941 (ESTSC–001030IB48600) **CLF. Clean Lead Facility (CLF) Inventory System.** Garcia, J.F. (Lockheed Idaho Technologies Company, Idaho Falls, ID, (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 May 1995. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-94ID13223. Source: ESTSC.

Description: IBM PC 486; MS-DOS 6.2 (or PC-DOS 6.3), Micr1 3.5 Diskette. Computer and Operating System Requirements are needed to operate the Inventory System. A complete understanding of the CLF Inventory System and the User's Manual is suggested to ensure data integrity.

The CLF Inventory System records shipments of clean or nonradioactive contaminated lead stored at the CLF. The Inventory System provides reports and inventory information to Facility operators. Annual, quarterly, monthly, and current inventory reports may be printed. Profile reports of each shipment of lead may also be printed for verification and documentation of lead transactions.

22942 (ESTSC–001031SUN0000) **XFLOW. Crossflow Cooling Analysis Program.** Yucel, Adnan (Superconducting Super Collider Laboratory, Waxahachie, TX (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). 1 May 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: SUN; Sun OS, VAX/VMS, MS-DOS, etc.; Fortran 77; 1 Tape. Compile and link xflow.f, descol.f, dnsqe.f and rkf45.f; then run the executable. File formats are given in README file in 'doc' directory.

Crossflow cooling analysis program to predict pressure drops and temperature rises in the annular and main cooling channels of collider dipole magnets (The upper channels are orificied at the inlet, the lower channels at the exits). Used in the analysis, design, and optimization of crossflow cooling for superconducting magnets.

22943 (ESTSC–001043CY00100) **BACON12. Bounce-Averaged Fokker-Planck Code.** Rognlien, T.D. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Apr 1988. Sponsored by USDOE, Washington, DC (United States). (NESC–9534). Source: ESTSC.

Description: CRAY1; CTSS; LRLTRAN (CIVIC); 1 Tape. BACON12 calls several routines specific to the LLNL computing environment; these routines are not included.

BACON12 solves the Fokker-Planck equation for electron or ion distribution, f(v,theta), confined in an electrostatic and magnetic well, where (v,theta) are spherical velocity coordinates with theta measured with respect to the static magnetic field. It was developed to model ions trapped in a magnetic mirror. The influences of Coulomb collision, radio frequency heating, and neutral beam injection are included. The code calculates the particle and energy confinement time of particles confined in a magnetic well. BACON12 is written in conservation form, which results in the line density being conserved exactly except at phase space boundaries.

22944 (ESTSC–001044C760000) **BASELIB. a library of basic system functions.** Getchell, A. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Nov 1983. Sponsored by USDOE, Washington, DC (United States). (NESC–9899). Source: ESTSC.

Description: CDC7600; LTSS; COMPASS; 1 Mag Tape.

BASELIB is a support library for developing high-level library software. Its design is adaptable to other applications (utility routines, compilers, loaders, large application systems, etc.). BASELIB functions perform commonly-used system and I/O requests available in LTSS operating systems. BASELIB routines are machine-dependent; they are closely tied to the machine and operating system for which they were programmed. However, an attempt was made to maintain compatibility and consistency across machines at the BASELIB calling level to provide a common base for moving large software systems across machines. It allows the programmer to structure higher-level software in a machine- independent fashion. Miscellaneous routines are included to perform character and string manipulation, number conversion, and output-file name generation.

22945 (ESTSC–001044CY00100) **BASELIB. A Library of Basic System Functions.** Getchell, A. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Nov 1988. Sponsored by USDOE, Washington, DC (United States). (NESC–9899). Source: ESTSC.

Description: CRAY1; CTSS; CAL (86%) and LRLTRAN (14%); 1 Mag Tape.

BASELIB is a support library for developing high-level library software. Its design is adaptable to other applications (utility routines, compilers, loaders, large application systems, etc.). BASELIB functions perform commonly-used system and I/O requests available in LTSS operating systems. BASELIB routines are machine dependent; they are closely tied to the machine and operating system for which they were programmed. However, an attempt was made to maintain compatibility and consistency across machines at the BASELIB calling level to provide a common base for moving large software systems across machines. It allows the programmer to structure higher level software in a machine independent fashion. Miscellaneous routines are included to perform character and string manipulation, number conversion, and output-file name generation.

22946 (ESTSC–001047C007400) **GEOCITY. Geothermal District Heating Economics.** Huber, H.D. (Pacific Northwest Lab., Richland, WA (United States)); McDonald, C.L.; Bloomster, C.H.; Schulte, S.C. Pacific Northwest Lab., Richland, WA (United States). 1 Oct 1978. Sponsored by USDOE, Washington, DC (United States). (NESC–835). Source: ESTSC.

Description: CDC CYBER74; SCOPE 3.4.2; FORTRAN IV; 1 Tape. GEOCITY includes 63 subroutines comprising the 1967 ASME Steam Tables which are used to calculate the thermodynamic and physical properties of water, including pressure, temperature, enthalpy, specific volume, density, viscosity, and fluid quality. The NAMELIST utility is used to process the GEOCITY input data.

GEOCITY is a large-scale simulation model which combines both engineering and economic submodels to systematically calculate the cost of geothermal district heating systems for space heating, hot-water heating, and process heating based upon hydrothermal geothermal resources. The GEOCITY program simulates the entire production, distribution, and waste disposal process for geothermal district heating systems, but does not include the cost of radiators, convectors, or other in-house heating systems. GEOCITY calculates the cost of district heating based on the climate, population, and heat demand of the district; characteristics of the geothermal resource and distance from the distribution center; well-drilling costs; design of the distribution system; tax rates; and financial conditions.

22947 (ESTSC–001055D664000) **SWTK. Software Tracking Systems.** Laurie Harness (SSC Laboratory, Information Services (United States)); Laural McGilvery. Fermi National Accelerator Lab., Batavia, IL (United States). 27 Sep 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Source: ESTSC.

Description: DEC VAX6640; DEC VMS 5.5-2; DEC VMS DCL, Oracle SQL*Plus, Oracle SQL*Forms, Oracle SQL*Menu. None.

The Software Tracking System was used to track single user software licenses and MacRanch (Keyserver) licenses at the SSCL. Information retained on software concerned the identification and the issuee for each license. During the SSCL termination, the application will record the final distribution of the software per DOE orders.

22948 (ESTSC–001056IBMPC00) **OLIGOSYN. Hardware Controller DNA Synthesizer.** Sindelar, L.E. (Lawrence Berkeley National Laboratory, Berkeley, CA, (United States)). Lawrence Berkeley Lab., CA (United States). 24 Jan 1994. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Source: ESTSC.

Description: IBM PC; MS-DOS, Version 5.00 (off the shMicrosoft Visual Basic, Version 3.0 (100%); 1 3.5 Diskette. The software is written in Visual Basic Programming language and as such the Microsoft Visual Basic, Version 3.0 file naming conventions are used.

The program controls the operation of various hardware components of an automatic 12-channel parrallel oligosynthesizer. This involves accepting information regarding the DNA sequence to be generated and converting this into a series of instructions to I/O ports to actuate the appropriate hardware components. The design and function of the software is specific to a particular hardware platform and has no utility for controlling other configurations.

22949 (ESTSC–001057D642000) **STAR. System for Tracking Applicants and Resumes.** Mark Aiken (SSC Laboratory, Information Services (United States)); Terry Teague; Andy Wall. Fermi National Accelerator Lab., Batavia, IL (United States). 6 Jan 1993. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: DEC VAX6420; DEC VMS 5.5-2; Powerhouse, DEC VMS DCL. None.

The STAR System was used by the Recruiting office to track job applicants and requisitions for personnel at the SSCL.

22950 (FNAL/C–95/056) **Collaborating over the web: Libraries and laboratries or the librarian and the webmaster.** Garrett, P. (Sydney Univ., NSW (Australia). Fisher Library); Ritchie, D.J. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9504144–1: AusWeb '95: 1. Austrialian WWW conference, New South Wales (Australia), 29 Apr - 2 may 1995). Order Number DE95010572. Source: OSTI; NTIS; INIS; GPO Dep.

Fermilab [HREF1] has been using World Wide Web [HREF2] (WWW) servers and browsers for the past several years. The purpose has been to allow information sharing within internationally dispersed teams of large collaborations of high energy physics experimenters and to make possible the easy dissemination of information by support groups who work with those collaborations. That is, the purpose has been in fact that for which was created at CERN [HREF3] beginning in March 1989. In the remainder of this paper, we describe the architecture of the Laboratory and Library servers, discuss the goals, the implications of those goals, the drivers of structure and content, and the effect of these factors on the architecture. Comparisons are made. The implications for Libraries within organizations are described. The application to large Libraries which begin to have multiple servers within their own organization (e.g., one in reference, one in cataloging, one in circulation) is made. The broader implications are discussed.

22951 (LA-UR–95-1221) **Elements of a theory of simulation.** Rasmussen, S. (Los Alamos National Lab., NM (United States)); Barrett, C.L. Los Alamos National Lab., NM (United States). [1995]. 16p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9509164–1: European conference on artifical life (ECAL), Barcelona (Spain), Sep 1995). Order Number DE95012995. Source: OSTI; NTIS; GPO Dep.

Artificial Life and the more general area of Complex Systems does not have a unified theoretical framework although most theoretical work in these areas is based on simulation. This is primarily due to an insufficient representational power of the classical mathematical frameworks for the description of discrete dynamical systems of interacting objects with often complex internal states. Unlike computation or the numerical analysis of differential equations, simulation does not have a well established conceptual and mathematical foundation. Simulation is an arguable unique union of modeling and computation. However, simulation also qualifies as a separate species of system representation with its own motivations, characteristics, and implications. This work outlines how simulation can be rooted in mathematics and shows which properties some of the elements of such a mathematical framework has. The properties of simulation are described and analyzed in terms of properties of dynamical systems. It is shown how and why a simulation produces emergent behavior and why the analysis of the dynamics of the system being simulated always is an analysis of emergent phenomena. Indeed, the single fundamental class of properties of the natural world that simulation will open to new understanding, is that which occurs only in the dynamics produced by the interactions of the components of complex systems. Simulation offers a synthetic, formal framework for the experimental mathematics of representation and analysis of complex dynamical systems. A notion of a universal simulator and the definition of simulatabuity is proposed. This allows a description of conditions under which simulations can distribute update functions over system components, thereby determining simulatability. The connection between the notion of simulatability and the notion of computability is defined and the concepts are distinguished.

22952 (LA-UR–95-1411) **Bicriteria network design problems.** Marathe, M.V. (Los Alamos National Lab., NM (United States)); Ravi, R.; Sundaram, R.; Ravi, S.S.; Rosenkrantz, D.J.; Hunt, H.B. III. Los Alamos National Lab., NM (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9506188–1: International coloquium on automata languages (ICALP '95), Szeged (Hungary), Jun 1995). Order Number DE95012052. Source: OSTI; NTIS; GPO Dep.

We study several bicriteria network design problems phrased as follows: given an indirected graph and two minimization objectives with a budget specified on one objective, find a subgraph satisfying certain connectivity requirements that minimizes the second objective subject to the budget on the first. First, we develop a formalism for bicriteria problems and their approximations. Secondly, we use a simple parametric search technique to provide bicriteria approximation algorithms for problems with two similar criteria, where both criteria are the same measure (such as the diameter or the total cost of a tree) but differ only in the cost function under which the measure is computed. Thirdly, we present an (O(log n), O(log n))-approximation algorithm for finding a diameter-constrained minimum cost spanning tree of an undirected graph on n nodes. Finally, for the class of treewidth-bounded graphs, we provide pseudopolynomial-time algorithms for a number of bicriteria problems using dynamic programming. These pseudopolynomial-time algorithms can be converted to fully polynomial-time approximation schemes using a scaling technique.

22953 (LBL–36680) **A distributed parallel storage architecture and its potential application within EOSDIS.** Johnston, W.E. (Lawrence Berkeley Lab., CA (United States)); Tierney, B.; Feuquay, J.; Butzer, T. Lawrence Berkeley Lab., CA (United States). Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9503106–2: Goddard conference on mass storage and technolgies, College Park, MD (United States), 28-30 Mar 1995). Order Number DE95012325. Source: OSTI; NTIS; GPO Dep.

We describe the architecture, implementation, use, and potential use of a scale, high-performance, distributed-parallel data storage system developed in the ARPA funded MAGIC gigabit testbed. A collection of wide area distributed disk servers operate in parallel to provide logical block level access to large data sets. Operated primarily as a network-based cache, the architecture supports cooperation among independently owned resources to provide fast, large-scale, on-demand storage to support data handling, simulation, and computation.

22954 (NUREG/CR–0200-Vol.2-Pt.2-Rev.4) **SCALE: A modular code system for performing standardized computer analyses for licensing evaluation. Functional modules F9–F16 – Volume 2, Part 2, Revision 4.** West, J.T. (Oak Ridge National Lab., TN (United States)); Hoffman, T.J.; Emmett, M.B.; Childs, K.W.; Petrie, L.M.; Landers, N.F.; Bryan, C.B.; Giles, G.E. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Oak Ridge National Lab., TN (United States). Apr 1995. 853p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NUREG/CSD–2/R4-Vol.2-Pt.2). Source: OSTI; NTIS; GPO; INIS.

SCALE–a modular code system for Standardized Computer Analyses Licensing Evaluation–has been developed by Oak Ridge National Laboratory at the request of the US Nuclear Regulatory Commission. The SCALE system utilizes well-established computer codes and methods within standard analysis sequences that (1) allow an input format designed for the occasional user and/or novice, (2) automate the data processing and coupling between modules, and (3) provide accurate and reliable results. System development has been directed at problem-dependent cross-section processing and analysis of criticality safety, shielding, heat transfer, and depletion/decay problems. Since the initial release of SCALE in 1980, the code system has been heavily used for evaluation of nuclear fuel facility and package designs. This revision documents Version 4.2 of the system. The manual is divided into three volumes: Volume 1–for the control module documentation, Volume 2–for

functional module documentation; and Volume 3–for documentation of the data libraries and subroutine libraries. This volume discusses the following functional modules: MORSE-SGC; HEATING 7.2; KENO V.a; JUNEBUG-II; HEATPLOT-S; REGPLOT 6; PLORIGEN; and OCULAR.

22955 (NUREG/CR–0200-Vol.3-Rev.4) **SCALE: A modular code system for performing standardized computer analyses for licensing evaluation. Miscellaneous – Volume 3, Revision 4.** Petrie, L.M. (Oak Ridge National Lab., TN (United States)); Jordon, W.C.; Edwards, A.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Oak Ridge National Lab., TN (United States). Apr 1995. 766p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NUREG/CSD–2/R4-Vol.3). Source: OSTI; NTIS; GPO; INIS.

SCALE–a modular code system for Standardized Computer Analyses Licensing Evaluation–has been developed by Oak Ridge National Laboratory at the request of the US Nuclear Regulatory Commission. The SCALE system utilizes well-established computer codes and methods within standard analysis sequences that (1) allow an input format designed for the occasional user and/or novice; (2) automate the data processing and coupling between modules, and (3) provide accurate and reliable results. System developments has been directed at problem-dependent cross-section processing and analysis of criticality safety, shielding, heat transfer, and depletion/decay problems. Since the initial release of SCALE in 1980, the code system has been heavily used for evaluation of nuclear fuel facility and package designs. This revision documents Version 4.2 of the system. This manual is divided into three volumes: Volume 1–for the control module documentation, Volume 2–for the functional module documentation, and Volume 3–for the data libraries and subroutine libraries.

22956 (PNL-SA–25658) **Performance of a fully parallel dense real symmetric eigensolver in quantum chemistry applications.** Fann, G.I.; Littlefield, R.J.; Elwood, D.M. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950439–11: SMS simulation multiconference: simulation as a critical technology, Phoenix, AZ (United States), 9-13 Apr 1995). Order Number DE95011496. Source: OSTI; NTIS; GPO Dep.

The parallel performance of a dense, standard and generalized, real, symmetric eigensolver based on bisection for eigenvalues and repeated inverse iteration and reorthogonalization for eigenvectors is described. The performance of this solver, called PeIGS, is given for two test problems and for three "real-world" quantum chemistry applications: SCF-Hartree-Fock, density functional theory,and Moeller-Plesset theory. The distinguishing feature of the repeated inverse iteration and orthogonalization method used by PEIGS is that orthogonalization may be performed across multiple processors as dictated by the spectrum. For each problem we describe the spectrum and the clustering of the eigenvalues, the most important factor in determining the execution time. For a spectrum that is well spaced, there is essentially no orthogonalization time. Most of the time is consumed in the Householder reduction to tridiagonal form. For large clusters, almost all of the time is consumed in the Householder reduction and in orthogonalization. Performance results from the Intel Paragon, and Kendall Square Research KSR-2 are reported.

22957 (PNL-SA–25920) **Workshop on environmental and energy applications of neural networks.** Hashem, S. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503142–1: Workshop on environmental and energy applications of neural networks conference, Richland, WA (United States), 30-31 Mar 1995). Order Number DE95011419. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of the abstracts for the papers given at the conference. Applications of neural networks in the environmental, energy and biomedical fields are discussed. Some of the topics covered are: predicting atmospheric pollutant concentrations due to fossil-fired electric power generation; hazardous waste characterization; nondestructive TRU (transuranic) waste assay; risk analysis; load forecasting for electric utilities; design of a wind power storage and generation system; nuclear fuel management; etc.

22958 (SAND–95-0753C) **A reconfigurable optoelectronic interconnect technology for multi-processor networks.** Lu, Y.C. (Univ. of New Mexico, Albuquerque, NM (United States). Center for High Technology Materials); Cheng, J.; Zolper, J.C.; Klem, J. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505121–3: 45. electronic components and technology conference, Las Vegas, NV (United States), 22-26 May 1995). Order Number DE95011895. Source: OSTI; NTIS; GPO Dep.

This paper describes a new optical interconnect architecture and the integrated optoelectronic circuit technology for implementing a parallel, reconfigurable, multiprocessor network. The technology consists of monolithic array's of optoelectronic switches that integrate vertical-cavity surface-emitting lasers with three-terminal heterojunction phototransistors, which effectively combined the functions of an optical transceiver and an optical spatial routing switch. These switches have demonstrated optical switching at 200 Mb/s, and electrical-to-optical data conversion at $>$ 500 Mb/s, with a small-signal electrical-to-optical modulation bandwidth of $\sim$ 4 GHz.

22959 (SAND–95-1083C) **Lower bounds for randomized Exclusive Write PRAMs.** MacKenzie, P.D. Sandia National Labs., Albuquerque, NM (United States). 2 May 1995. 24p. Sponsored by USDOE, Washington, DC (United States);Texas State Government, Austin, TX (United States). DOE Contract AC04-94AL85000. (CONF-9507132–1: Symposium on parallel algorithms and architectures, Santa Barbara, CA (United States), 17-19 Jul 1995). Order Number DE95013022. Source: OSTI; NTIS; GPO Dep.

In this paper we study the question: How useful is randomization in speeding up Exclusive Write PRAM computations? Our results give further evidence that randomization is of limited use in these types of computations. First we examine a compaction problem on both the CREW and EREW PRAM models, and we present randomized lower bounds which match the best deterministic lower bounds known. (For the CREW PRAM model, the lower bound is asymptotically optimal.) These are the first non-trivial randomized lower bounds known for the compaction problem on these models. We show that our lower bounds also apply to the problem of approximate compaction. Next we examine the problem of computing boolean functions on the CREW PRAM model, and we present a randomized lower bound, which improves on the previous best randomized lower bound for many boolean functions, including the OR function. (The previous lower bounds for these functions were asymptotically optimal, but we improve the constant multiplicative factor.) We also give an alternate proof for the randomized lower bound on PARITY, which was already optimal to within a constant additive factor. Lastly, we give a randomized lower bound for integer merging on an EREW PRAM which matches the best deterministic lower bound known. In all our proofs, we use the Random Adversary method, which has previously only been used for proving lower bounds on models with Concurrent Write capabilities. Thus this paper also serves to illustrate the power and generality of this method for proving parallel randomized lower bounds.

22960 (SSCL–485) **Averaging in the presence of sliding errors.** Yost, G.P. (Superconducting Super Collider Lab., Dallas, TX (United States)). Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1991. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. G phy-8907526; G phy-8811054; G 85-07153. Order Number DE95011144. Source: OSTI; NTIS; INIS; GPO Dep.

In many cases the precision with which an experiment can measure a physical quantity depends on the value of that quantity. Not having access to the true value, experimental groups are forced to assign their errors based on their own measured value. Procedures which attempt to derive an improved estimate of the true value by a suitable average of such measurements usually weight each experiment's measurement according to the reported variance. However, one is in a position to derive improved error estimates for each experiment from the average itself, provided an approximate idea of the functional dependence of the error on the central

value is known. Failing to do so can lead to substantial biases. Techniques which avoid these biases without loss of precision are proposed and their performance is analyzed with examples. These techniques are quite general and can bring about an improvement even when the behavior of the errors is not well understood. Perhaps the most important application of the technique is in fitting curves to histograms.

22961 (SSCL-Preprint–61) **DECwrite v2.0: A novice's perspective.** Damrau, J. Superconducting Super Collider Lab., Dallas, TX (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9212135–1: Winter DECUS conference, Las Vegas, NV (United States), 7-11 Dec 1992). Order Number DE95011049. Source: OSTI; NTIS; INIS; GPO Dep.

This paper will show why I changed from using TeX to using DECwrite. The advantages for doing this are the import/export features, online readability through the Export to Bookreader – function, and its user-friendliness (similar to Microsoft Word, but more powerful). Another prime advantage of using DECwrite is the elimination of paper waste through the online readability format through the use of Bookreader.

22962 (SSCL-Preprint–547) **Bridging FORTRAN to object oriented paradigm for HEP data modeling task.** Huang, J. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9310317–1: 3. international workshop on software engineering, artifical intelligence (AI) and expert systems for high energy and nuclear physics, Oberammergau (Germany), 4-8 Oct 1993). Order Number DE95011032. Source: OSTI; NTIS; INIS; GPO Dep.

Object oriented (OO) technology appears to offer tangible benefits to the high energy physics (HEP) community. Yet many physicists view this newest software development used with much reservation and reluctance. Facing the reality of having to support the existing physics applications, which are written in FORTRAN, the software engineers in the Computer Engineering Group of the Physics Research Division at the Superconducting Super Collider Laboratory have accepted the challenge of mixing an old language with the new technology. This paper describes the experience and the techniques devised to fit FORTRAN into the OO paradigm (OOP).

22963 (UCRL-JC–118794) **A comparison of risk assessment techniques from qualitative to quantitative.** Altenbach, T.J. Lawrence Livermore National Lab., CA (United States). 13 Feb 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950740–36: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95011430. Source: OSTI; NTIS; GPO Dep.

Risk assessment techniques vary from purely qualitative approaches, through a regime of semi-qualitative to the more traditional quantitative. Constraints such as time, money, manpower, skills, management perceptions, risk result communication to the public, and political pressures all affect the manner in which risk assessments are carried out. This paper surveys some risk matrix techniques, examining the uses and applicability for each. Limitations and problems for each technique are presented and compared to the others. Risk matrix approaches vary from purely qualitative axis descriptions of accident frequency vs consequences, to fully quantitative axis definitions using multi-attribute utility theory to equate different types of risk from the same operation.

22964 (UCRL-JC–119044) **PMESH: A parallel mesh generator.** Hardin, D.D. Lawrence Livermore National Lab., CA (United States). 21 Oct 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410254–8: Nuclear explosives code developers conference (NECDC), Las Vegas, NV (United States), 27 Oct 1994). Order Number DE95011761. Source: OSTI; NTIS; GPO Dep.

The Parallel Mesh Generation (PMESH) Project is a joint LDRD effort by A Division and Engineering to develop a unique mesh generation system that can construct large calculational meshes (of up to 10^9 elements) on massively parallel computers. Such a capability will remove a critical roadblock to unleashing the power of massively parallel processors (MPPs) for physical analysis. PMESH will support a variety of LLNL 3-D physics codes in the areas of electromagnetics, structural mechanics, thermal analysis, and hydrodynamics.

22965 (UCRL-JC–119205) **Parallelizing Monte Carlo with PMC.** Rathkopf, J.A.; Jones, T.R.; Nessett, D.M.; Stanberry, L.C. Lawrence Livermore National Lab., CA (United States). Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410254–7: Nuclear explosives code developers conference (NECDC), Las Vegas, NV (United States), 27 Oct 1994). Order Number DE95010749. Source: OSTI; NTIS; INIS; GPO Dep.

PMC (Parallel Monte Carlo) is a system of generic interface routines that allows easy porting of Monte Carlo packages of large-scale physics simulation codes to Massively Parallel Processor (MPP) computers. By loading various versions of PMC, simulation code developers can configure their codes to run in several modes: serial, Monte Carlo runs on the same processor as the rest of the code; parallel, Monte Carlo runs in parallel across many processors of the MPP with the rest of the code running on other MPP processor(s); distributed, Monte Carlo runs in parallel across many processors of the MPP with the rest of the code running on a different machine. This multi-mode approach allows maintenance of a single simulation code source regardless of the target machine. PMC handles passing of messages between nodes on the MPP, passing of messages between a different machine and the MPP, distributing work between nodes, and providing independent, reproducible sequences of random numbers. Several production codes have been parallelized under the PMC system. Excellent parallel efficiency in both the distributed and parallel modes results if sufficient workload is available per processor. Experiences with a Monte Carlo photonics demonstration code and a Monte Carlo neutronics package are described.

22966 (UCRL-JC–120490) **Using distributed OLTP technology in a high performance storage system.** Tyler, T.W. (IBM Government Systems, Houston, TX (United States)); Fisher, D.S. Lawrence Livermore National Lab., CA (United States). Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950985–2: 14. Institute of Electrical and Electronics Engineers (IEEE) symposium on mass storage systems, Monterey, CA (United States), 11-14 Sep 1995). Order Number DE95011004. Source: OSTI; NTIS; GPO Dep.

The design of scaleable mass storage systems requires various system components to be distributed across multiple processors. Most of these processes maintain persistent database-type information (i.e., metadata) on the resources they are responsible for managing (e.g., bitfiles, bitfile segments, physical volumes, virtual volumes, cartridges, etc.). These processes all participate in fulfilling end-user requests and updating metadata information. A number of challenges arise when distributed processes attempt to maintain separate metadata resources with production-level integrity and consistency. For example, when requests fail, metadata changes made by the various processes must be aborted or rolled back. When requests are successful, all metadata changes must be committed together. If all metadata changes cannot be committed together for some reason, then all metadata changes must be rolled back to the previous consistent state. Lack of metadata consistency jeopardizes storage system integrity. Distributed on-line transaction processing (OLTP) technology can be applied to distributed mass storage systems as the mechanism for managing the consistency of distributed metadata. OLTP concepts are familiar to manN, industries such as banking and financial services but are less well known and understood in scientific and technical computing. As mass storage systems and other products are designed using distributed processing and data-management strategies for performance, scalability, and/or availability reasons, distributed OLTP technology can be applied to solve the inherent challenges raised by such environments. This paper discusses the benefits in

using distributed transaction processing products. Design and implementation experiences using the Encina OLTP product from Transarc in the High Performance Storage System are presented in more detail as a case study for how this technology can be applied to mass storage systems designed for distributed environments.

22967 (UCRL-JC-120716) **S.M.A.R.T. map: Site map attribute retrieval technique.** Brown-Rall, M. Lawrence Livermore National Lab., CA (United States). 29 Mar 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504158-2: CAD/CAE conference, Atlanta, GA (United States), 19 Apr 1995). Order Number DE95014126. Source: OSTI; NTIS; GPO Dep.

Plant Engineering's Space and Site Planning (S&SP) organization at Lawrence Livermore National Laboratory (LLNL) has developed a new tool, which is a computerized mapping system that can graphically illustrate facility characteristics. The current "base" map being used is the LLNL Site Map prepared by Plant Engineering's CADD Support group. Using current information in the Facility Information Tracking System (FITS) database, a Microsoft Excel spreadsheet, an electronic sort can be made, tying in the AutoCAD-generated site map to specific database fields. This link is accomplished by using a software overlay called the CadPLUS InfoEngine. The fields in the database include such things as, facility number, occupant program, population, facility age, facility quality, security level, etc. By selecting one or a combination of the fields, a map is generated, illustrating in color and hatch patterns the facilities or entities that are associated with the chosen fields. This process can be very useful for seeing the LLNL site at a glance, with highlighted characteristics for particular areas of interest. The generation of large complex graphics, using large-scale databases selectively, can be accomplished quickly. These extractions and links between data and graphics create a S.M.A.R.T. Map.

22968 (UCRL-LR-119304) **Dependency visualization for complex system understanding.** Smart, J.A.C. Lawrence Livermore National Lab., CA (United States). Sep 1994. 277p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011699. Source: OSTI; NTIS; GPO Dep.

With the volume of software in production use dramatically increasing, the importance of software maintenance has become strikingly apparent. Techniques now sought and developed for reverse engineering and design extraction and recovery. At present, numerous commercial products and research tools exist which are capable of visualizing a variety of programming languages and software constructs. The list of new tools and services continues to grow rapidly. Although the scope of the existing commercial and academic product set is quite broad, these tools still share a common underlying problem. The ability of each tool to visually organize object representations is increasingly impaired as the number of components and component dependencies within systems increases. Regardless of how objects are defined, complex "spaghetti" networks result in nearly all large system cases. While this problem is immediately apparent in modern systems analysis involving large software implementations, it is not new. As will be discussed in Chapter 2, related problems involving the theory of graphs were identified long ago. This important theoretical foundation provides a useful vehicle for representing and analyzing complex system structures. While the utility of directed graph based concepts in software tool design has been demonstrated in literature, these tools still lack the capabilities necessary for large system comprehension. This foundation must therefore be expanded with new orgnizational and visualization constructs necessary to meet this challenge. This dissertation addresses this need by constructing a conceptual model and a set of methods for interactively exploring, organizing, and understanding the structure of complex software systems.

22969 (UCRL-LR-120452) **An object-oriented extension for debugging the virtual machine.** Pizzi, R.G. Jr. (California Univ., Davis, CA (United States)). Lawrence Livermore National Lab., CA (United States). Dec 1994. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013229. Source: OSTI; NTIS; GPO Dep.

A computer is nothing more then a virtual machine programmed by source code to perform a task. The program's source code expresses abstract constructs which are compiled into some lower level target language. When a virtual machine breaks, it can be very difficult to debug because typical debuggers provide only low-level target implementation information to the software engineer. We believe that the debugging task can be simplified by introducing aspects of the abstract design and data into the source code. We introduce OODIE, an object-oriented extension to programming languages that allows programmers to specify a virtual environment by describing the meaning of the design and data of a virtual machine. This specification is translated into symbolic information such that an augmented debugger can present engineers with a programmable debugging environment specifically tailored for the virtual machine that is to be debugged.

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22970 (BNL-61765) **The U.S. Nuclear Data Network: Summary of the twentieth meeting.** Brookhaven National Lab., Upton, NY (United States). [1994]. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9410352-Summ.: 20. U.S. Nuclear Data Network meeting, Williamsburg, VA (United States), 25 Oct 1994). Order Number DE95012485. Source: OSTI; NTIS; INIS; GPO Dep.

Topics discussed at this meeting were: assessment of the nuclear data program from the perspective of the funding agency; status of high spin evaluations for ENSDF; recommendation for name change of master file from Nuclear Structure Reference to Nuclear Science Reference; status of ENSDF, Table of Isotopes, VuENSDF, on-line system at the NNDC, and Nuclear Data Sheets; summary of the discussion of the Formats and Procedures Subcommittee; long range plan for nuclear structure data; a description of methods of optimization of nuclear structure evaluations and how to evolve this activity into the forefront of research such as high-spin physics; code development which includes improvements in the databases and evaluator tools; and future means of data dissemination.

22971 (DOE/MT/95004-1) **Development of data management system for the assistance in conducting AOR in California. Quarterly report, January-March 1995.** Stettner, M. California State Dept. of Conservation, Sacramento, CA (United States). Div. of Oil, Gas and Geothermal Resources. 21 Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-95MT95004. Order Number DE95012183. Source: OSTI; NTIS; GPO Dep.

Project objectives are to provide the resources and capabilities to permit the State of California to conduct Area of Review (AOR) variance analyses on a statewide level, and includes: (1) the analysis and identification of areas that may qualify for AOR variances; (2) the correlation of information from various databases and other automated systems to conduct AORs in areas that do not qualify for variances; (3) the evaluation of the risk of pollution, during permitting and monitoring, using risk based data analysis; and (4) the conduct of spatial analyses of injection well data in conjunction with other geographically referenced information. The Division has identified the hardware and software equipment needed to implement the Risk Based Data Management System (RBDMS) and conduct AOR variances. A workshop to review the RBDMS was held on April 4, 1995 with Dan Arthur from CH2M Hill, Inc. Oil and gas industry representatives were invited to attend and were asked for their support by submitting digitized well information to populate the Division's data base.

22972 (ES/ER/TM-137) **Results of the user survey of functional requirements for the Oak Ridge Environmental Information System.** Oak Ridge National Lab., TN (United States). Mar 1995. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013299. Source: OSTI; NTIS; GPO Dep.

Environmental Restoration Program.

The Oak Ridge Environmental Information System (OREIS) user survey of functional requirements was conducted in the spring and summer of 1994 to allow representatives of the OREIS user community to review and confirm the functionality of the OREIS system and to provide a method to document user acceptance of the system. The results of the survey confirm that the OREIS system meets data and functional requirements of the users. It further emphasizes that the user community is quite diverse, with many different needs for and perspectives about OREIS, and with varying needs for access and use of software tools. To meet the needs of a diverse and potentially changing user community, OREIS staff will survey the user community periodically to obtain input on changes to user requirements for future versions of the system.

22973 (NUREG–0540-Vol.17-No.3) **Title list of documents made publicly available, March 1–31, 1995: Volume 17, No. 3.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. May 1995. 376p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979. NRC documents that are publicly available may be examined without charge at the NRC Public Document Room (PDR). Duplicate copies may be obtained for a fee. Standing orders for certain categories of documents are also available. Clients may search for and order desired titles through the PDR computerized Bibliographic Retrieval System, which is accessible both at the PDR and remotely. The PDR is staffed by professional technical librarians, who provide reference assistance to users. See NOTES at the end of the preface for information about reaching the PDR. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS).

22974 (PNL-SA–25720) **The visual analysis of textual information: Browsing large document sets.** Thomas, J. (Pacific Northwest Lab., Richland, WA (United States)); Pennock, K.; Fiegel, T.; Wise, J.; Pottier, M.; Schur, A.; Crow, V.; Lantrip, D. Pacific Northwest Lab., Richland, WA (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505210–1: DL '95 conference, Washington, DC (United States), 15-19 May 1995). Order Number DE95011488. Source: OSTI; NTIS; GPO Dep.

Visualization tools have been invaluable in the process of scientific discovery by providing researchers with insights gained through graphical tools and techniques. At PNL, the Multidimensional Visualization and Advanced Browsing (MVAB) project is extending visualization technology to the problems of intelligence analysis of textual documents by creating spatial representations of textual information. By representing an entire corpus of documents as points in a coordinate space of two or more dimensions, the tools developed by the MVAB team give the analyst the ability to quickly browse the entire document base and determine relationships among documents and publication patterns not readily discernible through traditional lexical means.

22975 (SAND–89-0996-Rev.) **Guide to preparing SAND reports. Revision.** Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 229p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95010196. Source: OSTI; NTIS; GPO Dep.

Supersedes SAND89-0996 dated September 1994.

This guide contains basic information needed to produce a SAND report; its guidelines reflect DOE regulations and Sandia policy. The guide includes basic writing instructions in an annotated sample report; guidance for organization, format, and layout of reports produced by line organizations; and information about conference papers, journal articles, and brochures. The appendixes contain sections on Sandia's preferred usage, equations, references, copyrights and permissions, and publishing terms.

22976 (UCRL-ID–120609) **Pratt and Whitney digital data delivery to San Antonio Air Logistics Centers EDCARS repository data: MIL-R-28002A Type 1 (Raster). Quick short test report.** Lawrence Livermore National Lab., CA (United States). Sep 1994. 49p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012479. Source: OSTI; NTIS; GPO Dep.

This report describes the effort undertaken by the principal participants: Pratt and Whitney, San Antonio-Air Logistics Center (SA-ALC), and the Air Force CALS Test Network (AFCTN), in developing a Continuous Acquisition and Life-cycle Support (CALS) digital data delivery process for PW229 Engine technical data. Both source and destination teams agree this delivery demonstrated a positive business case and additional potential for comprehensive process reengineering.

22977 (WSRC-MS–95-0031) **Incorporating bibliographic information into a spatial data query system for the Savannah River Site.** Cowen, D.J. (Univ. of South Carolina, Columbia, SC (United States). Dept. of Geography); Jensen, J.R.; MacCharles, C.V.; Holliday, W.N.; White, T.R.; Mackey, H.E. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9503141–1: Annual meeting of Society of Photogrammetry and Remote Sensing, Charlotte, NC (United States), 27 Mar - 2 apr 1995). Order Number DE95010965. Source: OSTI; NTIS; GPO Dep.

Over the past two years the Environmental Sciences Section of the Westinghouse Savannah River Company and the University of South Carolina have developed a full-featured spatial data query system for the Savannah River Site. This Environmental Data Atlas, which operates across multiple platforms, is designed to provide scientists with easy access to a wide range of GIS and remote sensing data resources. This paper describes the method that has been developed to extend the Environmental Data Atlas to incorporate bibliographical data. The bibliographic search function was determined by the scientists to be an extremely important enhancement that will enable them to utilize geographic keys to locate obscure references and databases. The method uses a Hot Link function to launch a parsing algorithm by pointing to geographic features. The parsing algorithm efficiently sorts through a list of references based on the keyword associated with the feature. The matched bibliographical entries are formatted into a text file that is displayed in a scrollable window. Any graphics associated with the actual reference can also be scanned and linked to an additional Hot Link. An additional parsing system was used to automatically create the bibliographical database from a comprehensive CD-ROM version of the Environmental Information Document prepared by the Environmental Sciences Section. This extensive digital reference represents a summary of much of the recent ecological information available on the site. The methods used in this system are directly linked to a commercially available software and provide a universal approach to establishing a geographically based document retrieval system.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in ETDE/PUB–3 (Rev.1), *International Energy: Research Organizations 1988–1992*. Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, indicated by International Organization for Standardization (ISO) country code; and (3) the language of the document if non-English (R;CA;In French). Author affiliations are not listed in this index.

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AC22-89PC89881	**Geo-Microbial Technologies, Inc., Ochelata, OK (United States)**	
	20:20541	DOE/PC/89881–T15
AC22-89PC89908	**Aspen Technology, Inc., Cambridge, MA (United States)**	
	20:20528	DOE/PC/89908–T32
AC22-90BC14652	**Oklahoma Univ., Norman, OK (United States)**	
	20:20610	DOE/BC/14652–15
AC22-90PC90045	**Texas A and M Univ., College Station, TX (United States). Research Foundation**	
	20:20543	DOE/PC/90045–T10
	20:20544	DOE/PC/90045–T11
	20:20545	DOE/PC/90045–T12
	20:20546	DOE/PC/90045–T13
	20:20547	DOE/PC/90045–T14

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AC22-90PC90054	Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering	
	20:20548	DOE/PC/90054–T6
	20:20549	DOE/PC/90054–T7
	20:20550	DOE/PC/90054–T8
	20:20551	DOE/PC/90054–T9
	20:20552	DOE/PC/90054–T10
	20:20553	DOE/PC/90054–T11
	20:20554	DOE/PC/90054–T12
AC22-90PC90155	Manufacturing and Technology Conversion International, Inc., Columbia, MD (United States)	
	20:20589	DOE/PC/90155–T13
AC22-90PC90184	Lovelace Insts., Albuquerque, NM (United States)	
	20:20581	DOE/PC/90184–T18
AC22-91PC90027	Bechtel National, Inc., Richland, WA (United States)	
	20:20542	DOE/PC/90027–T12
AC22-91PC90366	Battelle, Columbus, OH (United States)	
	20:21164	DOE/PC/90366–T13
AC22-91PC91030	Dow Corning Corp., Carrollton, KY (United States)	
	20:21705	DOE/PC/91030–T13
	20:21706	DOE/PC/91030–T14
AC22-91PC91051	Amoco Oil Co., Naperville, IL (United States). Research and Development Dept.	
	20:20556	DOE/PC/91051–T8-Vol.1
	20:20557	DOE/PC/91051–T9
AC22-91PC91055	Auburn Univ., AL (United States). Dept. of Chemical Engineering	
	20:20558	DOE/PC/91055–T11
AC22-91PC91160	ABB Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs.	
	20:20585	CONF-940780–9
	20:20590	DOE/PC/91160–T5
AC22-92BC14882	University of Southern Mississippi, Hattiesburg, MS (United States). Dept. of Polymer Science	
	20:21700	DOE/BC/14882–10
AC22-92BC14883	Illinois Inst. of Tech., Chicago, IL (United States)	
	20:20612	DOE/BC/14883–11
AC22-92BC14886	Surtek, Inc., Golden, CO (United States)	
	20:20613	DOE/BC/14886–11
AC22-92PC90367	Radian Corp., Austin, TX (United States)	
	20:21165	DOE/PC/90367–T13
AC22-92PC92112	SRI International, Menlo Park, CA (United States)	
	20:21105	DOE/PC/92112–T9
AC22-92PC92113	Worcester Polytechnic Inst., MA (United States)	
	20:21106	DOE/PC/92113–T7
AC22-92PC92149	CeraMem Corp., Waltham, MA (United States)	
	20:20560	DOE/PC/92149–T9
AC22-92PC92159	Combustion Engineering, Inc., Windsor, CT (United States)	
	20:20592	DOE/PC/92159–T11
	ABB Combustion Engineering, Inc., Windsor, CT (United States). ABB Power Plant Labs.	
	20:20591	DOE/PC/92159–T10
AC22-93BC14893	New Mexico Petroleum Recovery Research Center, Socorro, NM (United States)	
	20:20614	DOE/BC/14893–6
AC22-93BC14897	Wyoming Univ., Laramie, WY (United States)	
	20:20602	DOE/BC/14897–6
AC22-93PC93051	Pennsylvania State Univ., University Park, PA (United States). Coal and Organic Petrology Labs.	
	20:20573	DOE/PC/93051–T4
AC22-93PC93254	Southern Research Inst., Birmingham, AL (United States)	
	20:21166	DOE/PC/93254–T1
AC22-94PC91008	BDM Oklahoma, Inc., Bartlesville, OK (United States)	
	20:20633	NIPER/BDM–0086
AC22-94PC94155	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	20:20530	DOE/PC/94155–T1
AC24-92OR21972	Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)	
	20:21497	FEMP–2347
	20:22905	FEMP–2425
AC34-90RF62349	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
	20:21025	RFP–4826
	20:21766	RFP–4999
	Rocky Flats Environmental Technology Site, Golden, CO (United States)	
	20:21765	RFP–4954
AC35-89ER40486	Fermi National Accelerator Lab., Batavia, IL (United States)	
	20:22003	SSC–106
	20:22937	ESTSC–001023SPARC00
	20:22938	ESTSC–001025SUN0000
	20:22939	ESTSC–001026SGIIP00
	20:22940	ESTSC–001027SUN0000
	20:22942	ESTSC–001031SUN0000
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	Lawrence Berkeley Lab., CA (United States)	
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	20:21854	SSC-SR–1017
	20:21884	SSC-SR–1016
	20:21886	SSC-SR–1033
	20:22052	SSC-SR–1034
	Superconducting Super Collider Lab., Dallas, TX (United States)	
	20:21871	SSC–53-App.1
	20:21872	SSC–246
	20:21873	SSCL–622
	20:21874	SSCL-Preprint–38
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	20:21876	SSCL-Preprint–168
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	20:21880	SSCL-SR–1230
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	20:21882	SSC-SR–1012
	20:21885	SSC-SR–1022
	20:21887	SSC-SR–1237
	20:21921	SSCL–260
	20:21922	SSCL–508
	20:21923	SSCL–641
	20:21924	SSCL–650
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	20:21930	SSCL-Preprint–539
	20:21931	SSCL-Preprint–543
	20:21932	SSCL-Preprint–561-Rev.1
	20:21933	SSCL-SR–1038
	20:21934	SSCL-SR–1227
	20:21935	SSC-SR–1014
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	20:22533	SSCL-Preprint–554
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	20:22538	SSCL–412
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	20:22558	SSCL-Preprint–21
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	20:22560	SSCL-Preprint–526
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	20:22578	SSCL-Preprint–534
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	Superconducting Super Collider Lab., Waxahachie, TX (United States)	
	20:21883	SSC-SR–1015
AC36-83CH10093	**National Renewable Energy Lab., Golden, CO (United States)**	
	20:20600	NREL/SP–440-6642
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	20:21076	DOE/GO–10095-166
	20:21080	NREL/SP–420-7849
	20:21100	NREL/TP–433-7867
	20:21107	NREL/TP–425-7607
	20:21114	NREL/TP–413-7991
	20:21115	NREL/TP–413-8008
	20:21116	NREL/TP–451-8017
	20:21117	DOE/GO–10095-072
	20:21119	NREL/TP–411-8006
	20:21120	NREL/TP–472-7850
	20:21151	NREL/SP–441-7814
	20:21334	NREL/TP–473-7783
	20:21378	NREL/TP–400-7830
	20:21386	DOE/GO–10095-076
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	20:21459	DOE/GO–10095-060
	20:21460	DOE/GO–10095-087
	20:21481	DOE/GO–10095-171
	20:21494	DOE/GO–10095-170
	20:21518	NREL/CP–462-7900
	20:21519	NREL/TP–463-7844
	20:21538	NREL/TP–425-7529
	20:21539	NREL/TP–425-7609
	20:21694	NREL/CP–433-7748
	20:22237	NREL/TP–463-5784
	20:22321	NREL/TP–430-7973
AI02-93ER61551	**National Oceanic and Atmospheric Administration, Camp Springs, MD (United States). Science Center**	
	20:22500	CONF-9310433–Absts.
AI02-94ER61759	**National Oceanic and Atmospheric Administration, Boulder, CO (United States)**	
	20:22169	CONF-9409357–Summ.
AI05-87ER13770	**National Inst. of Standards and Technology, Boulder, CO (United States). Chemical Sciences and Technology Lab.**	
	20:21681	DOE/ER/13770–T3
AI05-90OR21921	**Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab.**	
	20:20781	DOE/OR/21921–T2
AI05-92ER54177	**Naval Research Lab., Washington, DC (United States)**	
	20:21901	DOE/ER/54177–T2
AI05-93OR22088	**Fish and Wildlife Service, Hawaii National Park, HI (United States). Hawaii Research Station**	
	20:21139	DOE/OR/22088–T1
	20:21140	DOE/OR/22088–T2
AI05-93OR22089	**Minerals Management Service, Menlo Park, CA (United States)**	
	20:21135	USGS-OFR–94-553
	20:22252	USGS-OFR–94-569
AI08-92NV10874	**Geological Survey, Denver, CO (United States)**	
	20:20843	USGS-OFR–94-342
	Geological Survey, Las Vegas, NV (United States)	
	20:22264	CONF-9509121–1

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	USDOE Nevada Operations Office, Las Vegas, NV (United States)	
	20:20844	USGS-OFR-94-456
AI21-92MC29078	**Texas Univ., Austin, TX (United States). Bureau of Economic Geology**	
	20:20605	DOE/MC/29078-95/C0469
AI79-93BP00029	**Pacific Northwest Lab., Richland, WA (United States)**	
	20:22343	DOE/BP/00029-1
AR21-93MC30362	**Carnegie-Mellon Univ., Pittsburgh, PA (United States). Robotics Inst.**	
	20:21731	DOE/MC/30362-4049
AT21-93MC30139	**Geological Survey, Lakewood, CO (United States)**	
	20:20698	DOE/MC/30139-3971
	Geological Survey, Denver, CO (United States). Petroleum Geology Branch	
	20:20697	DOE/MC/30139-95/C0457
FC01-94CE15602	**Whalen-Shaw (Michael), Circleville, OH (United States)**	
	20:21492	DOE/CE/15602-T2
FC02-90CE27504	**Public Technology, Inc., Washington, DC (United States)**	
	20:21382	DOE/CE/27504-T12
FC02-92CE41003	**Alzeta Corp., Santa Clara, CA (United States)**	
	20:21827	DOE/CE/41003-T1
FC04-92AL82993	**Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development**	
	20:21002	DOE/AL/82993-10
FC04-94AL98817	**International Business Machines Corp., Endicott, NY (United States)**	
	20:21832	DOE/AL/98817-2
FC05-90CE40905	**Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div.**	
	20:21074	DOE/CE/40905-57
FC05-93CE40006	**Institute of Paper Science and Technology, Atlanta, GA (United States)**	
	20:21493	DOE/CE/40006-T1
FC07-90ID12911	**Vortec Corp., Collegeville, PA (United States)**	
	20:21495	DOE/ID/12911-1
FC07-91ID13074	**Kansas State Univ., Manhattan, KS (United States)**	
	20:21527	DOE/ID/13074-T15
FC07-93ID13230	**Alabama Univ., Birmingham, AL (United States). Dept. of Materials Science and Engineering**	
	20:21576	DOE/ID/13230-T1
FC09-86SR15160	**South Carolina Dept. of Natural Resources, Columbia, SC (United States)**	
	20:22273	DOE/SR/15160-6-Vol.1
	20:22274	DOE/SR/15160-7-Vol.2
FC21-89MC26042	**American Electric Power Service Corp., Columbus, OH (United States)**	
	20:20534	DOE/MC/26042-4047
FC21-89MC26268	**Utah Univ., Salt Lake City, UT (United States)**	
	20:20726	DOE/MC/26268-3822
FC21-90MC26029	**Sun Co., Inc., Marcus Hook, PA (United States). Research and Development Dept.**	
	20:21103	DOE/MC-26029-95/C0461
FC21-90MC27286	**Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research**	
	20:20727	DOE/MC/27286-3310
FC21-91MC27363	**Tampa Electric Co., FL (United States)**	
	20:21155	DOE/MC/27363-3966
FC21-91MC28176	**Appalachian Oil and Natural Gas Research Consortium, Morgantown, WV (United States)**	
	20:20695	DOE/MC-28176-95/C0468
FC21-92MC28065	**M-C Power Corp., Burr Ridge, IL (United States)**	
	20:21156	DOE/MC/28065-4014
FC21-92MC28178	**Institute of Gas Technology, Des Plaines, IL (United States)**	
	20:20701	DOE/MC/28178-95/C0467
FC21-93MC30070	**CER Corp., Las Vegas, NV (United States)**	
	20:20704	DOE/MC/30070-95/C0470
FC21-93MC30251	**Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research**	
	20:20577	DOE/MC/30251-4034
FC21-93MC30252	**Southern Illinois Univ., Carbondale, IL (United States)**	
	20:20578	DOE/MC/30252-4024
FC21-94MC30056	**Praxis Engineers, Inc., Milpitas, CA (United States)**	
	20:20536	DOE/MC/30056-4046
FC22-87PC79796	**Energy and Environmental Research Corp., Irvine, CA (United States)**	
	20:20587	DOE/PC/79796-T42
	Energy and Environmental Research Corp., Bartonville, IL (United States)	
	20:20586	DOE/PC/79796-T38-Vol.2
FC22-89PC88697	**Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center**	
	20:20588	DOE/PC/88697-T10
FC22-92PC92162	**Consortium for Coal-Water Slurry Fuel Technology, University Park, PA (United States)**	
	20:20529	DOE/PC/92162-T5
FC22-93BC14951	**Tulsa Univ., OK (United States)**	
	20:20615	DOE/BC/14951-10
FC22-93BC14954	**Diversified Operating Corp., New Raymer, CO (United States)**	
	20:20616	DOE/BC/14954-10
FC22-93BC14955	**American Oil Recovery, Inc., Decatur, IL (United States)**	
	20:20617	DOE/BC/14955-8
FC22-93BC14958	**Lomax Exploration Co., Denver, CO (United States)**	
	20:20618	DOE/BC-14958-10
FC22-93PC92578	**Missouri Univ., Columbia, MO (United States). Capsule Pipeline Research Center**	
	20:20582	DOE/PC/92578-T7
FC22-94BC14983	**Michigan Technological Univ., Houghton, MI (United States)**	
	20:20620	DOE/BC/14983-4
FC22-94BC14984	**Luff Exploration Co., Denver, CO (United States)**	
	20:20621	DOE/BC/14984-3
FC22-94BC14986	**Texaco Exploration and Production, Inc., Midland, TX (United States)**	
	20:20622	DOE/BC/14986-3
	20:20623	DOE/BC/14986-4
FC22-94BC14991	**Phillips Petroleum Co., Bartlesville, OK (United States)**	
	20:20624	DOE/BC/14991-3
FC36-94GO10039	**Clean Air Now, Santa Monica, CA (United States). Project Office**	
	20:21069	DOE/GO/10039-T1
	Clean Air Now, Santa Monica, CA (United States)	
	20:21068	DOE/GO/10039-2

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FG01-90CE90043	American Chemical Society, Washington, DC (United States)	
	20:21339	DOE/CE/90043–T2
FG01-93EP10050	East-West Center, Honolulu, HI (United States)	
	20:20655	DOE/EP/10050–T5
	20:21415	DOE/EP/10050–T6
FG01-94CE15606	Blake (F.H.) and Associates, Mill Creek, CA (United States)	
	20:21455	DOE/CE/15606–T3
FG01-94EH89439	Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.	
	20:22168	CONF-940738–Summ.
FG02-84ER13183	Wisconsin Univ., Madison, WI (United States). Dept. of Chemical Engineering	
	20:21701	DOE/ER/13183–10
FG02-84ER13291	Wisconsin Univ., Madison, WI (United States). Dept. of Chemical Engineering	
	20:20647	DOE/ER/13291–T1
	20:22935	ESTSC–000847MLTPL00
FG02-84ER45158	Oak Ridge National Lab., TN (United States)	
	20:21573	CONF-9509118–5
FG02-85ER53198	Wisconsin Univ., Madison, WI (United States). Dept. of Physics	
	20:22845	DOE/ER/53198–259
FG02-86ER13460	Yale Univ., New Haven, CT (United States)	
	20:21703	DOE/ER/13460–3
	20:21704	DOE/ER/13460–6
	Yale Univ., New Haven, CT (United States). Dept. of Chemistry	
	20:21702	DOE/ER/13460–1
FG02-86ER45278	Cornell Univ., Ithaca, NY (United States)	
	20:22783	DOE/ER/45278–T2
FG02-88ER12815	Ohio State Univ. Research Foundation, Columbus, OH (United States)	
	20:21298	DOE/ER/12815–T1-Pt.1
	20:21299	DOE/ER/12815–T1-Pt.2
	20:21300	DOE/ER/12815–T1-Pt.3
FG02-88ER13916	Ohio State Univ., Columbus, OH (United States). Dept. of Physics	
	20:22520	DOE/ER/13916–T3
FG02-88ER40408	Lawrence Berkeley Lab., CA (United States)	
	20:22765	LBL–37020
FG02-88ER40412	Lawrence Berkeley Lab., CA (United States)	
	20:22765	LBL–37020
FG02-88ER45372	Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy	
	20:21574	DOE/ER–45372-8
FG02-88ER52149	Wisconsin Univ., Madison, WI (United States)	
	20:22876	DOE/ER/52149–3
	20:22877	DOE/ER/52149–T1
FG02-89ER12900	Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering	
	20:21301	DOE/ER/12900–T1
	20:21302	DOE/ER/12900–T2
FG02-89ER14004	Ohio State Univ., Columbus, OH (United States). Dept. of Horticulture	
	20:22378	DOE/ER/14004–T2
FG02-89ER40531	Lawrence Berkeley Lab., CA (United States)	
	20:22765	LBL–37020
FG02-90ER12972	Illinois Univ., Urbana, IL (United States). Nuclear Reactor Lab.	
	20:21263	DOE/ER/12972–T2
FG02-90ER61009	Columbia Univ., New York, NY (United States)	
	20:22402	DOE/ER/61009–T1
FG02-90ER61058	Wisconsin Univ., Madison, WI (United States)	
	20:22166	CONF-930346–7
FG02-91CE23810	Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States)	
	20:21456	DOE/CE/23810–51C
	20:21457	DOE/CE/23810–57
	20:21458	DOE/CE/23810–59A
FG02-91ER45439	Los Alamos National Lab., NM (United States)	
	20:22830	LA-UR–94-1148
FG02-91ER45441	Boston Univ., MA (United States). Dept. of Physics	
	20:21649	DOE/ER/45441–T1
FG02-91ER61218	Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science	
	20:22167	CONF-940115–33
FG02-92ER40702	Tufts Univ., Medford, MA (United States). Dept. of Physics and Astronomy	
	20:22698	DOE/ER/40702–9
FG02-92ER61363	Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science	
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FG02-93ER25156	Minnesota Univ., Minneapolis, MN (United States). Inst. for Mathematics and Its Applications	
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FG02-93ER61625	Michigan State Univ., East Lansing, MI (United States)	
	20:22401	CONF-9309110–Summ.
FG02-94ER40852	Texas Univ., Austin, TX (United States). Center for Particle Physics	
	20:22564	DOE/ER/40757–059
FG02-94ER61780	Connecticut Univ., Storrs, CT (United States)	
	20:22364	DOE/ER/61780–1
FG02-94ER75993	USDOE, Washington, DC (United States)	
	20:21340	DOE/ER/75993–1
FG03-88ER45378	California Univ., Los Angeles, CA (United States). Dept. of Physics	
	20:22522	DOE/ER/45378–T5
FG03-89ER14081	Stanford Univ., CA (United States). Dept. of Applied Earth Sciences	
	20:20603	DOE/ER/14081–T4
	20:20604	DOE/ER/14081–T5
FG03-93ER40757	Texas Univ., Austin, TX (United States). Center for Particle Physics	
	20:22564	DOE/ER/40757–059
FG03-93ER45488	Arizona Univ., Tucson, AZ (United States). Dept. of Physics	
	20:21650	DOE/ER/45488–5
FG03-94ER40833	Lawrence Berkeley Lab., CA (United States)	
	20:22557	LBL–37016
FG03-94ER54241	Texas Univ., Austin, TX (United States). Fusion Research Center	
	20:22846	DOE/ER/54241–138
FG03-95ER45531	Rice Univ., Houston, TX (United States)	
	20:21651	DOE/ER/45531–1
FG05-80ET53088	Texas Univ., Austin, TX (United States). Fusion Research Center	
	20:22523	DOE/ET/53088–706
	20:22848	DOE/ET/53088–707
	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	20:22501	DOE/ET/53088–669
	20:22847	DOE/ET/53088–703

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FG05-86ER40293	Middle Tennessee State Univ., Murfreesboro, TN (United States)	
	20:22697	DOE/ER/40293–9
FG05-87ER40319	Lawrence Berkeley Lab., CA (United States)	
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FG05-88ER40399	Texas A and M Univ., College Station, TX (United States). Cyclotron Inst.	
	20:22580	DOE/ER/40399–5
FG05-88ER40437	Lawrence Berkeley Lab., CA (United States)	
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FG05-88ER45361	North Carolina Agricultural and Technical State Univ., Greensboro, NC (United States). Dept. of Electrical Engineering	
	20:21648	DOE/ER/45361–3
FG05-88ER53266	Texas Univ., Austin, TX (United States). Fusion Research Center	
	20:22927	DOE/ER/53266–50
FG05-89ER14003	Oklahoma Univ., Norman, OK (United States). Dept. of Botany and Microbiology	
	20:22359	DOE/ER/14003–6
FG05-89ER40530	Tennessee Technological Univ., Cookeville, TN (United States)	
	20:22696	CONF-9402139–1
FG05-93ER40808	West Georgia Coll., Carrollton, GA (United States). Dept. of Physics	
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FG05-94ER40882	Texas Mfg. Technology Center, Waco, TX (United States)	
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FG06-89ER75522	Pacific Northwest Lab., Richland, WA (United States)	
	20:20818	PNL-SA–24937
FG06-90ER40561	Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory	
	20:22521	DOE/ER/40561–194
	20:22563	DOE/ER/40561–176
	20:22647	DOE/ER/40561–188
FG06-92ER54176	Washington Univ., Seattle, WA (United States). Aerospace and Energetics Research Program	
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FG07-93ID13220	Idaho Univ., Idaho Falls, ID (United States)	
	20:21575	DOE/ID/13220–T4
FG09-87SR15191	South Carolina Dept. of Natural Resources, Columbia, SC (United States)	
	20:22275	DOE/SR/15191–T1
FG09-91SR18217	Medical Univ. of South Carolina, Charleston, SC (United States)	
	20:22376	CONF-950168–Absts.
FG21-90MC27115	Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering	
	20:21682	DOE/MC/27115–95/C0478
FG21-92MC29228	Lehigh Univ., Bethlehem, PA (United States)	
	20:21104	DOE/MC/29228–95/C0462
FG21-93MC30084	Oklahoma Univ., Norman, OK (United States). Sarkeys Energy Center	
	20:21418	DOE/MC/30084–3864
FG21-94MC31182	West Virginia Univ. Research Corp., Morgantown, WV (United States)	
	20:20699	DOE/MC/31182–95/C0479
FG22-90PC90287	California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering	
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FG22-90PC90293	Georgia Inst. of Tech., Atlanta, GA (United States)	
	20:20555	DOE/PC/90293–T15
FG22-91PC91297	Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering	
	20:20583	MAE–304
	20:21711	MAE–303
FG22-91PC91310	Western Research Inst., Laramie, WY (United States)	
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FG22-91PC91311	Auburn Univ., AL (United States). Dept. of Chemical Engineering	
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FG22-92BC14852	Stanford Univ., CA (United States). Dept. of Petroleum Engineering	
	20:20611	DOE/BC/14852–12
FG22-92PC92528	Stanford Univ., CA (United States). High Temperature Gasdynamics Lab.	
	20:20593	DOE/PC/92528–9
FG22-93PC93203	Arkansas Univ., Little Rock, AR (United States)	
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FG22-93PC93218	State Univ. of New York, Binghamton, NY (United States). Dept. of Chemistry	
	20:20561	DOE/PC/93218–6
FG22-93PC93226	Brigham Young Univ., Provo, UT (United States)	
	20:20594	DOE/PC/93226–T6
FG22-94BC14977	New Mexico Petroleum Recovery Research Center, Socorro, NM (United States)	
	20:20619	DOE/BC–14977-4
FG22-94MT94003	Underground Injection Practices Research Foundation, Oklahoma City, OK (United States)	
	20:20658	DOE/MT/94003–3
FG22-94PC94206	Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering	
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FG22-94PC94209	Notre Dame Univ., IN (United States)	
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FG22-94PC94213	Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering	
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FG22-94PC94219	Clemson Univ., SC (United States). Dept. of Chemical Engineering	
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FG22-94PC94227	Massachusetts Inst. of Tech., Cambridge, MA (United States). Energy Lab.	
	20:21162	CONF-9410328–1
FG22-95MT95004	California State Dept. of Conservation, Sacramento, CA (United States). Div. of Oil, Gas and Geothermal Resources	
	20:22971	DOE/MT/95004–1
FG22-95MT95006	Oklahoma Energy Resources Board, Oklahoma City, OK (United States)	
	20:20659	DOE/MT/95006–1
FG36-86SF16306	Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab.	
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Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

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61224	20:21955	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011814	MF-414; MF-406
61225	20:22054	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011813	MF-414
61226	20:21956	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011812	MF-414

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61234	20:21957	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011811	MF-414
61264	20:21958	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011810	MF-414
61363	20:22162	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012305	MF-402
61419	20:22646	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007676	MF-414
61496	20:21897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013509	MF-411
61504	20:22498	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008867	MF-403
61505	20:22916	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008868	MF-900
61515	20:22691	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008863	MF-414
61518	20:22692	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008861	MF-414
61520	20:20729	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008859	MF-400
61521	20:20598	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008858	MF-104; MF-113
61523	20:22693	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008857	MF-414
61525	20:22694	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008866	MF-414
61527	20:21898	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008865	MF-414
61542	20:21168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009043	MF-107
61604	20:22163	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011349	MF-607
61615	20:22400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013320	MF-610
61645	20:21261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011401	MF-406
61648	20:20766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010449	MF-2030
61649	20:21292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011402	MF-505; MF-523
61650	20:22695	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010448	MF-413
61651	20:20767	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011403	MF-2030
61720	20:22774	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013845	MF-410
61736	20:20648	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012317	MF-121; MF-131
61748	20:22561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012316	MF-414
61765	20:22970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012485	MF-413
61769	20:21113	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012517	MF-1414
61775	20:22579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012081	MF-414
61776	20:21859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012518	MF-414
61787	20:22055	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012082	MF-414
61788	20:21899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012315	MF-414
61794	20:22562	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013321	MF-414
61815	20:22164	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013319	MF-402
61847	20:21959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013250	MF-411; MF-406
61858	20:21942	*See* ANL/XFD/CP–84868			
61878	20:21960	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013316	MF-406
BNL-NUREG–					
52394	20:22463	*See* NUREG/CR–6112			
60573	20:21293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008862	
61664	20:22499	OSTI; NTIS; INIS; GPO		TI95011774	
BNWL-CC–					
2591-Rev.1	20:20735	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010033	MF-500
CAO–					
94-1005-Rev.1-Vol.1	20:20768	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009611	MF-2000
CDTN-DERL-CN–					
020/88	20:22262	OSTI; NTIS (US Sales Only); INIS		DE95632468	
CEA-CONF–					
11769	20:21613	OSTI; NTIS (US Sales Only); INIS		DE95630982	
11774	20:22917	OSTI; NTIS (US Sales Only); INIS		DE95632488	
11826	20:22918	OSTI; NTIS (US Sales Only); INIS		DE95631666	
11828	20:21294	OSTI; NTIS (US Sales Only); INIS		DE95631673	
11843	20:22919	OSTI; NTIS (US Sales Only); INIS		DE95631675	
11883	20:21961	OSTI; NTIS (US Sales Only); INIS		DE95631318	
11888	20:22821	OSTI; NTIS (US Sales Only); INIS		DE95632116	
11898	20:21564	OSTI; NTIS (US Sales Only); INIS		DE95630865	
11970	20:21348	OSTI; NTIS (US Sales Only); INIS		DE95631167	
11971	20:21171	OSTI; NTIS (US Sales Only); INIS		DE95631360	
12001	20:21820	OSTI; NTIS (US Sales Only); INIS		DE95631334	
12006	20:20769	OSTI; NTIS (US Sales Only); INIS		DE95631534	
12007	20:20770	OSTI; NTIS (US Sales Only); INIS		DE95632473	
CEA-DAPNIA–					
94-08	20:22071	OSTI; NTIS (US Sales Only); INIS		DE95631504	
94-25	20:21962	OSTI; NTIS (US Sales Only); INIS		DE95632426	

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CEA-DAPNIA-SEA–					
94-03	20:21963	OSTI; NTIS (US Sales Only); INIS		DE95632469	
CEA-LNS-SAF–					
94-22	20:21900	OSTI; NTIS (US Sales Only); INIS		DE95632423	
CEA-SFID–					
2.b	20:22902	OSTI; NTIS (US Sales Only); INIS		DE95632492	
CHEC-R–					
9306	20:20532	OSTI; NTIS		DE95787754	
CIEMAT–					
759	20:21729	OSTI; NTIS		DE95780848	
CONF-8505408–		(Workshop on realistic SSC lattices; Berkeley, CA (United States); May - 4 jun 1985)			
	20:21883	*See* SSC-SR–1015			
CONF-8506212–		(SSC impedance workshop; Berkeley, CA (United States); 26-27 Jun 1985)			
	20:21854	*See* SSC-SR–1017			
CONF-8510522–		(SSC workshop on environmental radiation; Berkeley, CA (United States); 14-18 Oct 1985)			
Summ.	20:21884	*See* SSC-SR–1016			
CONF-8710536–		(SSC workshop on distributed multipole correction coils; Upton, NY (United States); 13-14 Oct 1987)			
Summ.	20:22051	*See* SSC-SR–1032			
CONF-8909505–		(Underground Technology Advisory Panel (UTAP) meeting; DeSoto, TX (United States); 18-19 Sep 1989)			
Summ.	20:21872	*See* SSC–246			
CONF-8910591–		(10. national seminar on production and transmission of electric power; Curitiba (Brazil); 1-5 Oct 1989)			
	20:20579	*See* INIS-BR–3523			
	20:21111	*See* INIS-BR–3538			
	20:21325	*See* INIS-BR–3526			
CONF-900348–		(2. international industrialization symposium on the super collider (IISSC); Miami, FL (United States); 14-16 Mar 1990)			
25	20:22007	*See* SSCL–274			
26	20:22006	*See* SSCL–271			
CONF-9009329–		(Workshop on physics at UNK; Protvino (USSR); 25-28 Sep 1990)			
2	20:22008	*See* SSCL–332			
CONF-910340–		(3. annual international industrialization symposium on the super collider (IISSC); Atlanta, GA (United States); 13-15 Mar 1991)			
55	20:22010	*See* SSCL–453			
CONF-9109331–		(4. workshop on high energy spin physics; Protvino (USSR); 3 Sep 1991)			
	20:22590	*See* INIS-RU–405			
CONF-9202111–		(4. generation light sources workshop; Stanford, CA (United States); 24-27 Feb 1992)			
8	20:21926	*See* SSCL-Preprint–182			
CONF-9206240–		(2. Long Duration Exposure Facility (LDEF) post-retrieval symposium; San Diego, CA (United States); 1-5 Jun 1992)			
3	20:22102	*See* PNL-SA–20757			
CONF-920828–		(American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings; Pacific Grove, CA (United States); 30 Aug - 5 sep 1992)			
31	20:21464	*See* LBL–32420			
CONF-9212135–		(Winter DECUS conference; Las Vegas, NV (United States); 7-11 Dec 1992)			
1	20:22961	*See* SSCL-Preprint–61			
CONF-930014–		(1993 objected-oriented numerics conference; Snowbird, CO (United States); 1993)			
1	20:22920	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012887	MF-405
CONF-930133–		(73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993)			
13	20:22165	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008980	MF-412

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CONF-930331–		(6. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing; Norfolk, VA (United States); 21-24 Mar 1993)			
16	20:22921	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012867	MF-405
CONF-930346–		(Optical Society of America meeting on optical remote sensing of the atmosphere; Salt Lake City, UT (United States); 8-12 Mar 1993)			
7	20:22166	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013015	MF-402; MF-405; MF-412
CONF-930511–		(PAC '93: international particle accelerator conference; Washington, DC (United States); 17-20 May 1993)			
523	20:22034	*See* SSCL-Preprint–431			
524	20:22035	*See* SSCL-Preprint–434			
CONF-930537–		(5. annual international industrial symposium on the Super Collider and exhibition; San Francisco, CA (United States); 6-8 May 1993)			
110	20:22033	*See* SSCL-Preprint–422			
111	20:22029	*See* SSCL-Preprint–291			
112	20:22026	*See* SSCL-Preprint–265			
113	20:22028	*See* SSCL-Preprint–269			
114	20:22030	*See* SSCL-Preprint–298			
115	20:22031	*See* SSCL-Preprint–313			
116	20:22105	*See* SSCL-Preprint–256			
117	20:22039	*See* SSCL-Preprint–471			
120	20:22040	*See* SSCL-Preprint–479			
121	20:22027	*See* SSCL-Preprint–267			
CONF-930621–		(American Society of Mechanical Engineers (ASME) fluids engineering conference; Washington, DC (United States); 20-24 Jun 1993)			
	20:22919	*See* CEA-CONF–11843			
CONF-930640–		(RT '93: 8th IEEE conference on real-time computer applications in nuclear, particle and plasma physics; Vancouver (Canada); 8-11 Jun 1993)			
9	20:22036	*See* SSCL-Preprint–450			
CONF-930703–		(International cryogenic materials conference (ICMC); Albuquerque, NM (United States); 12-16 Jul 1993)			
46	20:22037	*See* SSCL-Preprint–455			
CONF-9307124–		(17. international conference on defects in semiconductors; Gmunden (Austria); 18-23 Jul 1993)			
4	20:21657	*See* LBL–34499			
CONF-9307220–		(Modeling, mesh generation and adaptive numerical methods for partial differential equations program; Minneapolis, MN (United States); 6-23 Jul 1993)			
1	20:22922	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011540	MF-405
CONF-9308266–		(International conference on scanning tunneling microscopy; Beijing (China); 9-14 Aug 1993)			
1	20:22118	*See* LBL–34503			
CONF-9308267–		(Nordic seminar on biomass gasification and combustion; Trondheim (Norway); 30 Aug 1993)			
	20:21086	*See* NEI-NO–569			
CONF-930906–		('93 international conference on nuclear waste management and environmental remediation; Prague (Czech Republic); 5-11 Sep 1993)			
	20:20770	*See* CEA-CONF–12007			
CONF-9309110–		(International symposium on molecular mechanisms of radiation and chemical carcinogen-induced cell transformation; Mackinac Island, MI (United States); 19-24 Sep 1993)			
Summ.	20:22401	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009803	MF-408
CONF-930926–		(13. international conference on magnet technology; Victoria (Canada); 20-24 Sep 1993)			
41	20:22043	*See* SSCL-Preprint–508			

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42 CONF-9309333–	20:22042	*See* SSCL-Preprint–500 (5. international symposium on refined flow modelling and turbulence measurements; Paris (France); 7-10 Sep 1993)			
CONF-9309489–	20:22918	*See* CEA-CONF–11826 (8. international magnetic measurement workshop; Waxahachie, TX (United States); 27-30 Sep 1993)			
CONF-931005–	20:21934	*See* SSCL-SR–1227 (6. international topical meeting on nuclear reactor thermal hydraulics; Grenoble (France); 5-8 Oct 1993)			
CONF-9310317–	20:21294	*See* CEA-CONF–11828 (3. international workshop on software engineering, artifical intelligence (AI) and expert systems for high energy and nuclear physics; Oberammergau (Germany); 4-8 Oct 1993)			
1 CONF-9310338–	20:22962	*See* SSCL-Preprint–547 (17. meeting of the Society for Reactor Safety; Koeln (Germany); 6-7 Oct 1993)			
CONF-931039–	20:21305	*See* GRS–110 (6. workshop on RF superconductivity; Newport News, VA (United States); 4-8 Oct 1993)			
4 CONF-9310433–	20:22046	*See* SSCL-Preprint–525 (Cloud-radiation interactions and their parameterization in climate models; Camp Springs, MD (United States); 18-20 Oct 1993)			
Absts. CONF-9311314–	20:22500	OSTI; NTIS; GPO Dep. (2. seminar on radiation physics; Cairo (Egypt); 20-21 Nov 1993)	E 1.99:	DE95011484	MF-402; MF-412
CONF-9311319–	20:21060	*See* INIS-mf–14535 (Research co-ordination meeting on intercomparison of liquid metal fast reactor seismic analysis codes; Vienna (Austria); 16-17 Nov 1993)			
CONF-931178–	20:21196	*See* IAEA-TECDOC–798 (5. international Toki conference on plasma physics and controlled nuclear fusion: physics and technology of plasma heating and current drive; Toki (Japan); 16-19 Nov 1993)			
CONF-9312108–	20:22849	*See* EUR-CEA-FC–1507 (NORSAC '93: 3. Nordic symposium on atmospheric chemistry; Geilo (Norway); 3-5 Dec 1993)			
CONF-940115–	20:22215	*See* NILU-OR–20/94 (74. American Meteorological Society annual meeting; Nashville, TN (United States); 23-28 Jan 1994)			
33 CONF-940136–	20:22167	OSTI; NTIS; GPO Dep. (27. Hawaii international conference on system sciences; Maui, HI (United States); 4-7 Jan 1994)	E 1.99:	DE95008979	MF-412
Summ. CONF-940169–	20:22364	*See* DOE/ER/61780–1 (10. winter workshop on nuclear dynamics; Snowbird, UT (United States); 15-21 Jan 1994)			
12 CONF-9402139–	20:22694	*See* BNL–61525 (RIKEN symposium on nuclear dynamics at finite temperature; Tokyo (Japan); Feb 1994)			
1 CONF-9402146–	20:22696	OSTI; NTIS; INIS; GPO Dep. (1994 New England Regional science bowl; Cambridge, MA (United States); 26 Feb 1994)	E 1.99:	DE95013488	MF-413
Summ. CONF-9403225–	20:21340	*See* DOE/ER/75993–1 (International symposium on medium energy physics; Beijing (China); Mar 1994)			
1	20:22695	*See* BNL–61650			

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CONF-9403229–		(Long-range transported pollutants. Supplies, effects and critical loads; Grimstad (Norway); 7-9 Mar 1994)			
	20:21366	*See* NILU-OR–17/94			
CONF-9403230–		(3. Technology Talks; Paris (France); 15-16 Mar 1994)			
	20:21961	*See* CEA-CONF–11883			
CONF-9404100–		(Symposium on the non-proliferation experiment results and implications for test ban treaties; Rockville, MD (United States); 19-21 Apr 1994)			
	20:21553	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011413	MF-940
CONF-9404121–		(2. Conference on object-oriented numerics (OONSKI '94); Sun River, OR (United States); 24 Apr 1994)			
4	20:22927	*See* DOE/ER/53266–50			
CONF-9404139–		(Workshop on polarons and bipolarons in high Tc superconductors; Cambridge (United Kingdom); 7-9 Apr 1994)			
	20:22821	*See* CEA-CONF–11888			
CONF-940416–		(96. annual meeting of the American Ceramic Society (ACS); Indianapolis, IN (United States); 25-28 Apr 1994)			
34	20:21626	*See* LBL–36924			
CONF-9404162–		(1994 chemical analysis by laser interrogation of proliferation effluents (CALIOPE ITR) interim technical review; Livermore, CA (United States); 26-28 Apr 1994)			
22	20:22249	*See* UCRL-JC–118287			
CONF-940424–		(8. international conference on radiation shielding; Arlington, TX (United States); 24-27 Apr 1994)			
	20:22917	*See* CEA-CONF–11774			
39	20:21877	*See* SSCL-Preprint–559			
CONF-9404251–		(Federation of Americal Societies for Experimental Biology (FASEB) symposium; Anaheim, CA (United States); 24-28 Apr 1994)			
2	20:22356	*See* LBL–36332			
CONF-9404261–		(Self-organization of biopolymers; Jena (Germany); 10-13 Apr 1994)			
1	20:21655	*See* LA-UR–95-1543			
CONF-9404262–		(1. world congress on computational medicine, public health and biotechnology; Austin, TX (United States); 24-28 Apr 1994)			
1	20:22367	*See* LA-UR–95-1478			
CONF-9404263–		(All-Russia conference of applied aspects of radiobiology; Moscow (Russian Federation); 19-20 Apr 1994)			
	20:22395	*See* INIS-RU–406			
CONF-9404264–		(International seminar on design and manufacturing of copper canisters for nuclear waste; Sollentuna (Sweden); 27-28 Apr 1994)			
	20:20826	*See* SKI-R–95-6			
CONF-9404265–		(3. international symposium in situ and on-site bioreclamation; San Diego, CA (United States); 24-27 Apr 1994)			
1	20:20660	*See* PNL-SA–24717			
CONF-9404266–		(International emergency management and engineering conference; Hollywood Beach, FL (United States); 18-21 Apr 1994)			
1	20:22210	*See* NILU-F–7/94			
CONF-9404267–		(OECD workshop on trade and environment: PPMs issues; Helsinki (Finland); 6-7 Apr 1994)			
1	20:21365	*See* NILU-F–9/94			
CONF-9404269–		(Energy Facility Contractors Group (EFCOG) meeting; Knoxville, TN (United States); 4 Apr 1994 - 6 apr 1995)			
1	20:21727	*See* ANL/IFR/CP–85395			

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CONF-940451–		(Parallel processing symposium; Cancun (Mexico); 26-29 Apr 1994)			
2	20:22923	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012891	MF-405
CONF-9405100–		(Scalable high performance computing conference; Knoxville, TN (United States); 23 May 1994)			
13	20:22912	*See* ANL/MCS/CP–86474			
14	20:22924	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012872	MF-405
CONF-9405116–		(16. international symposium on discharges and electrical insulation in vacuum: commercial applications and opportunities; Moscow (Russian Federation); 23-30 May 1994)			
	20:21963	*See* CEA-DAPNIA-SEA–94-03			
CONF-9405170–		(10. international conference on positron annihilation; Beijing (China); 23-29 May 1994)			
10	20:22774	*See* BNL–61720			
CONF-940528–		(13. international symposium on thermal treatment technologies; Houston, TX (United States); 9-13 May 1994)			
	20:20769	*See* CEA-CONF–12006			
CONF-9405322–		(International conference on monsoon variability and prediction; Trieste (Italy); 9-13 May 1994)			
1	20:22248	*See* UCRL-JC–117494			
CONF-9405323–		(Workshop on European monitoring, modelling and assessment of heavy metals and persistent organic pollutants; Beekbergen (Netherlands); 3-5 May 1994)			
1	20:22211	*See* NILU-F–8/94			
CONF-940552–		(10. topical conference on high-temperature plasma diagnostics; Rochester, NY (United States); 8-12 May 1994)			
47	20:22865	*See* PPPL–3108			
CONF-940582–		(CLEO '94: conference on lasers and electro-optics; Anaheim, CA (United States); 8-13 May 1994)			
8	20:22114	*See* UCRL-JC–116858			
CONF-940592–		(4. international colloquium on X-ray lasers; Williamsburg, VA (United States); 16-20 May 1994)			
11	20:22868	*See* UCRL-JC–118380			
12	20:21849	*See* UCRL-JC–117794			
CONF-9406241–		(Inversion methods in ocean and seismic acoustics conference; La Spezia (Italy); 27 Jun 1994)			
2	20:22117	*See* UCRL-JC–119287			
CONF-9406267–		(IIT '94 conference; Catania (Italy); 13-17 Jun 1994)			
2	20:22799	*See* LBL–35963			
CONF-940630–		(11. topical meeting on the technology of fusion energy; New Orleans, LA (United States); 19-24 Jun 1994)			
56	20:22890	*See* UCRL-JC–117467			
57	20:22889	*See* UCRL-JC–117397			
CONF-940631–		(34. annual conference of the Canadian Nuclear Association; 15. annual conference of the Canadian Nuclear Society; Montreal (Canada); 5-8 Jun 1994)			
	20:21348	*See* CEA-CONF–11970			
CONF-9406335–		(26. national symposium on fracture mechanics; Idaho Falls, ID (United States); 28-30 Jun 1994)			
1	20:21565	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012844	MF-404
CONF-9406336–		(Vision EUREKA conference on new technology for management and maintenance of Europe's old and new built environment; Hamar (Norway); 13-16 Jun 1994)			
1	20:21666	*See* NILU-F–18/94			

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CONF-9406337--		(AGU Chapman conference on hydrogeologic processes: Building and testing atomistic- to basin-scale models; Lincoln, NH (United States); 6-9 Jun 1994)			
Absts.	20:22263	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013091	MF-403
CONF-9406338--		(Colloquium on plutonium: a new nuclear fuel; Paris (France); 9 Jun 1994)			
	20:21171	*See* CEA-CONF--11971			
CONF-940714--		(International meeting on synchrotron radiation instrumentation; Stony Brook, NY (United States); 18-22 Jul 1994)			
54	20:21987	*See* LBL--36350			
55	20:22070	*See* ANL/XFD/CP--82883			
CONF-9407179--		(National Avian-wind power planning meeting; Lakewood, CA (United States); 20-21 Jul 1994)			
	20:21151	*See* NREL/SP--441-7814			
CONF-9407184--		(5. international Otto Schott colloquium; Jena (Germany); 11-14 Jul 1994)			
1	20:22794	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012869	MF-404
CONF-9407185--		(Conference on Quantitative Non Destructive Evaluation; Denver, CO (United States); 31 Jul - 5 aug 1994)			
	20:21820	*See* CEA-CONF--12001			
CONF-940722--		(27. international conference on high energy physics; Glasgow (United Kingdom); 21-27 Jul 1994)			
46	20:22768	*See* UCRL-JC--118789			
CONF-940723--		(Annual meeting of the Society of Photo-Optical Instrumentation Engineers; San Diego, CA (United States); 24-29 Jul 1994)			
41	20:22108	*See* UCRL-JC--119293			
42	20:21824	*See* UCRL-JC--118241			
CONF-940738--		(23. DOE/NRC nuclear air cleaning and treatment conference; Buffalo, NY (United States); 25-28 Jul 1994)			
12	20:20983	*See* UCRL-JC--119798			
8-Rev.1	20:21775	*See* UCRL-JC--115891-Rev.1			
Summ.	20:22168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009112	MF-602
CONF-940766--		(19. international congress on electron microscopy; Paris (France); 17-22 Jul 1994)			
	20:21564	*See* CEA-CONF--11898			
	20:21613	*See* CEA-CONF--11769			
CONF-940780--		(10. annual coal preparation, utilization and environmental control contractors conference; Pittsburgh, PA (United States); 18-21 Jul 1994)			
9	20:20585	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012013	MF-113
CONF-9408125--		(17. international LINAC conference; Tsukuba (Japan); 21-26 Aug 1994)			
	20:21900	*See* CEA-LNS-SAF--94-22			
	20:21962	*See* CEA-DAPNIA--94-25			
CONF-940813--		(208. American Chemical Society national meeting; Washington, DC (United States); 21-26 Aug 1994)			
41	20:21677	*See* ANL/CHM/CP--85869			
CONF-9408146--		(16. international free electron laser conference; Stanford, CA (United States); 21-26 Aug 1994)			
14-Rev.	20:21985	*See* LBL--36055-Rev.			
CONF-9408236--		(Astronomical Society of the Pacific conference; Hague (Netherlands); 15-27 Aug 1994)			
1	20:22534	*See* UCRL-JC--119032			
CONF-9408240--		(Conference on traffic days at AUC; Aalborg (Denmark); 29-30 Aug 1994)			
	20:22208	*See* NEI-DK--2028			
Vol.1	20:22203	*See* NEI-DK--2026			
Vol.2	20:22204	*See* NEI-DK--2027			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940829–		(14. international colloquium on magnetic films and surfaces; Duesseldorf (Germany); 29 Aug - 2 sep 1994)			
4	20:21650	*See* DOE/ER/45488–5			
CONF-9409103–		(International symposia on high energy spin physics and polarization phenomena in nuclear physics; Bloomington, IN (United States); 15-22 Sep 1994)			
	20:22071	*See* CEA-DAPNIA–94-08			
CONF-9409177–		(Optical Society of America conference on extreme ultraviolet lithography; Monterey, CA (United States); 19-21 Sep 1994)			
7	20:22115	*See* UCRL-JC–119064			
CONF-9409257–		(24. international symposium on multiparticle dynamics; Vietri sul Mare (Italy); 12-19 Sep 1994)			
2	20:22540	*See* ANL-HEP-CP–94-79			
CONF-9409347–		(NATO Advanced Study Institute on metal-ligand interactions: structure and reactivity; Cetraro (Italy); 4-16 Sep 1994)			
1	20:21698	*See* ANL/CHM/CP–83703			
CONF-9409349–		(International workshop on an assessment of fundamental aspects of radiation damage production and accumulation in metals and alloys; Obninsk (Russian Federation); 12-18 Sep 1994)			
1	20:21563	*See* ANL/MSD/CP–86106			
CONF-9409350–		(4. seminar of Zentrale Informationsstelle Umweltberatung Bayern: Energy from renewable raw materials; Nuernberg (Germany); 22 Sep 1994)			
	20:21079	*See* GSF–01/95			
CONF-9409351–		(International workshop on solution techniques for large-scale computational fluid dynamics (CFD) problems; Montreal (Canada); 26-28 Sep 1994)			
1	20:22925	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012889	MF-405; MF-410
CONF-9409357–		(19. annual meeting of Working Group VIII of the Joint US-Russian Committee on Cooperation in the field of protection of the environment and natural resources; St. Petersburg (Russian Federation); 11-17 Sep 1994)			
Summ.	20:22169	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011483	MF-402
CONF-941001–		(41. annual American Vacuum Society symposium; Denver, CO (United States); 24-28 Oct 1994)			
15	20:22888	*See* UCRL-JC–117325			
CONF-941006–		(SPIE annual conference of the Optical Society of America and exhibit; Boston, MA (United States); 30 Oct - 4 nov 1994)			
6	20:21848	*See* UCRL-JC–117360			
CONF-941013–		(Applied superconductivity conference; Boston, MA (United States); 16-21 Oct 1994)			
37	20:22107	*See* UCRL-JC–119291			
40	20:22098	*See* LBL–36711			
44	20:21983	*See* LBL–35423			
45	20:21986	*See* LBL–36306			
46	20:21984	*See* LBL–35425			
47	20:21982	*See* LBL–35419			
48	20:21625	*See* LBL–35424			
CONF-9410155–		(26. annual symposium on optical materials for high power lasers: Boulder damage symposium; Boulder, CO (United States); 24-26 Oct 1994)			
3	20:21850	*See* UCRL-JC–118281			
CONF-9410216–		(22. water reactor safety information meeting; Bethesda, MD (United States); 24-26 Oct 1994)			
Vol.1	20:21313	*See* NUREG/CP–0140-Vol.1			
Vol.3	20:21314	*See* NUREG/CP–0140-Vol.3			

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CONF-9410254–		(Nuclear explosives code developers conference (NECDC); Las Vegas, NV (United States); 27 Oct 1994)			
6	20:22144	*See* UCRL-JC–118788			
7	20:22965	*See* UCRL-JC–119205			
8	20:22964	*See* UCRL-JC–119044			
CONF-9410285–		(2. international workshop on heavy quark physics in fixed targets; Charlottesville, VA (United States); 6-10 Oct 1994)			
3	20:22579	*See* BNL–61775			
CONF-9410290–		(36. mechanical working and steel processing conference; Baltimore, MD (United States); Oct 1994)			
5	20:21566	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013206	MF-404
CONF-9410294–		(1994 symposium of the North Eastern Accelerator personnel (SNEAP-94); Kalamazoo, MI (United States); 12-15 Oct 1994)			
5	20:21964	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008976	MF-406
CONF-9410309–		(Contractor's coordination meeting; Dearborn, MI (United States); 24-27 Oct 1994)			
3	20:21535	*See* SAND–95-8522C			
4	20:21331	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008975	MF-404; MF-406
CONF-9410314–		(6. international workshop on radiative properties of hot dense matter; Sarasota, FL (United States); 31 Oct - 4 nov 1994)			
3	20:22870	*See* UCRL-JC–119826			
CONF-9410315–		(Collective effects in large hadron collider; Montreux (Switzerland); 17-22 Oct 1994)			
3	20:21898	*See* BNL–61527			
CONF-9410317–		(IHEP: 1994 Beijing calorimetry symposium; Beijing (China); 25-27 Oct 1994)			
5	20:22075	*See* FNAL/C–95/086			
CONF-9410328–		(Workshop on CO_2 ocean disposal; Tokyo (Japan); 28 Oct 1994)			
1	20:21162	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010507	MF-902
CONF-9410343–		(Applications of free-jet, molecular beam, mass spectrometric sampling conference; Estes Park, CO (United States); 11-14 Oct 1994)			
	20:21694	*See* NREL/CP–433-7748			
CONF-9410345–		(3. Millennium: man, his limits and his hopes; Vareena (Italy); 2-6 Oct 1994)			
1	20:21401	*See* UCRL-JC–118960			
CONF-9410349–		(38. conference on chemical research, chemical dynamics of transient species; Houston, TX (United States); 24-25 Oct 1994)			
1	20:21710	*See* LBL–36640			
CONF-9410352–		(20. U.S. Nuclear Data Network meeting; Williamsburg, VA (United States); 25 Oct 1994)			
Summ.	20:22970	*See* BNL–61765			
CONF-9410360–		(4. natural gas, power industry and the environment; Usti nad Labem (Czech Republic); 25-26 Oct 1994)			
	20:20716	*See* INIS-mf–14549			
CONF-941063–		(186. meeting of the Electrochemical Society; Miami, FL (United States); 9-14 Oct 1994)			
13	20:21330	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008977	MF-404; MF-406
CONF-941089–		(US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994)			
Vol.1	20:21152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011612	MF-101
Vol.2	20:21153	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011613	MF-101; MF-105; MF-102
CONF-9411152–		(International Atomic Energy Agency (IAEA) technical committee meeting on drivers for inertial confinement fusion; Paris (France); 14-18 Nov 1994)			
4	20:22891	*See* UCRL-JC–117491			

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CONF-9411174–		(8. international vacuum web coating conference; Las Vegas, NV (United States); 6-8 Nov 1994)			
2	20:21668	*See* PNL-SA–25157			
CONF-9411228–		(Minerals Management Service Information transfer meeting; New Orleans, LA (United States); 15-17 Nov 1994)			
1	20:20648	*See* BNL–61736			
CONF-9411229–		(Preparing for rural energy and economic development; Knoxville, TN (United States); 9-10 Nov 1994)			
1	20:21072	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012880	MF-920
CONF-941129–		(13. international conference on the application of accelerators in research and industry; Denton, TX (United States); 7-10 Nov 1994)			
24	20:21674	*See* UCRL-JC–118776			
25	20:22775	*See* UCRL-JC–112929			
26	20:22773	*See* UCRL-JC–117697			
CONF-941142–		(American Society of Mechanical Engineers' winter annual meeting; Chicago, IL (United States); 6-11 Nov 1994)			
33	20:21777	*See* UCRL-JC–117143			
CONF-941144–		(1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994)			
146	20:21451	*See* LBL–36813			
147	20:21562	*See* ANL/MSD/CP–83461			
148	20:21641	*See* ANL/MSD/CP–83373			
149	20:21662	*See* LBL–36911			
151	20:21261	*See* BNL–61645			
152	20:20525	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010508	MF-102
154	20:21567	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008970	MF-1420; MF-114
156	20:22111	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008973	MF-404
157	20:21661	*See* LBL–36909			
158	20:21568	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012893	MF-404
162-Rev.1	20:22791	*See* UCRL-JC–116442-Rev.1			
CONF-941227–		(5. symposium on current issues related to nuclear power plant structure, equipment and piping; Orlando, FL (United States); 14-16 Dec 1994)			
5	20:21030	*See* UCRL-JC–119591			
CONF-941251–		(4. international conference on physics beyond the standard model; Lake Tahoe, CA (United States); 13-18 Dec 1994)			
5	20:22556	*See* LBL–36962			
CONF-941268–		(4. U.S./Mexico joint symposium on atomic and molecular physics; San Juan Del Rio (Mexico); 7-10 Dec 1994)			
2	20:22771	*See* LBL–36919			
CONF-941270–		(Superplasticity - 60 years after Pearson conference; Manchester (United Kingdom); 7-8 Dec 1994)			
1	20:21636	*See* UCRL-JC–119217			
CONF-950001–		(NATO advanced research workshop on clouds, chemistry and climate; Heidelberg (Germany); 1995)			
1	20:22164	*See* BNL–61815			
CONF-950104–		(American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) winter meeting and exhibition; Chicago, IL (United States); 28 Jan - 1 feb 1995)			
9	20:21466	*See* LBL–36243			
CONF-950112–		(9. joint workshop on electron cyclotron emission and electron cyclotron resonance heating; Borrego Springs, CA (United States); 23-26 Jan 1995)			
2	20:22869	*See* UCRL-JC–119283			

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CONF-950127–		(11. international conference on ultra-relativistic nucleus-nucleus collisions; Monterey, CA (United States); 9-13 Jan 1995)			
6	20:22766	*See* UCRL-ID–119181			
7	20:22647	*See* DOE/ER/40561–188			
8	20:22693	*See* BNL–61523			
9	20:22691	*See* BNL–61515			
10	20:22692	*See* BNL–61518			
11	20:22764	*See* LBL–36883			
12	20:21859	*See* BNL–61776			
CONF-950129–		(19. annual conference on advanced ceramics, materials and structures; Cocoa Beach, FL (United States); 9-12 Jan 1995)			
7	20:21614	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012898	MF-1505
8	20:21615	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012899	MF-1502
9	20:21643	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013354	MF-1505; MF-111
CONF-950138–		(3. annual Middle East petroleum and gas conference: the re-emergence of oil giants; Muscat (Oman); 15-17 Jan 1995)			
1	20:21413	*See* ANL/OTD-EEST/CP–85089			
CONF-950163–		(3. international on-site analysis conference; Houston, TX (United States); 22-25 Jan 1995)			
4	20:22125	*See* LA-UR–95-610			
CONF-950168–		(1995 CDC/ATSDR symposium on statistical methods: small area statistics in public health: design, analysis graphic and spatial methods; Atlanta, GA (United States); 25-26 Jan 1995)			
1-Rev.	20:22377	*See* LBL–36630-Rev.			
Absts.	20:22376	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013877	MF-600
CONF-950172–		(Strangeness in hadronic matter conference; Tucson, AZ (United States); 3-7 Jan 1995)			
3	20:22099	*See* LBL–36908			
CONF-950186–		(2. world car conference; Riverside, CA (United States); 22-24 Jan 1995)			
1	20:21522	*See* ANL/ES/CP–84456			
2	20:21532	*See* ANL/ES/CP–84474			
3	20:21525	*See* ANL/ES/CP–84476			
CONF-950188–		(Reformulated fuels conference; Houston, TX (United States); 31 Jan - 2 feb 1995)			
1	20:22160	*See* ANL/ES/CP–84927			
CONF-950189–		(ASP conference: Cape workshop on magetic cataclysmic variables; Cape Town (South Africa); 23-25 Jan 1995)			
1	20:22535	*See* UCRL-JC–120557			
CONF-950191–		(23. international winter meeting on nuclear physics; Bormio (Italy); 23-28 Jan 1995)			
1	20:22765	*See* LBL–37020			
CONF-950195–		(Capital metals and materials forum on electric vehicle battery technology prospects for materials and commercialization; Washington, DC (United States); 18 Jan 1995)			
1	20:21329	*See* ANL/CMT/CP–85522			
CONF-950196–		(Air & Waste Management Association (AWMA) conference on acid rain & electric utilits: permits, allowances, monitoring & meteorology; Tempe, AZ (United States); 23-25 Jan 1995)			
1	20:22152	*See* ANL/DIS/CP–85637			
CONF-950201–		(Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS); Las Vegas, NV (United States); 12-16 Feb 1995)			
14	20:21606	*See* ANL/ET/CP–83802			
15	20:21584	*See* LA-UR–95-739			
16	20:21675	*See* UCRL-JC–119412			
18	20:22872	*See* ANL/ET/CP–83726			

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CONF-950209–		(4. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 22-24 Feb 1995)			
9	20:21380	*See* ANL/ER/CP–85412			
11	20:20771	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013353	MF-2070
CONF-9502100–		(Workshop on the Summer Research Intership Program; Newport News, VA (United States); 16-17 Feb 1995)			
1	20:22916	*See* BNL–61505			
CONF-9502101–		(Frontiers 95: a workshop on future directions of massively parallel processing; McLean, VA (United States); 6-9 Feb 1995)			
1	20:22909	*See* ANL/MCS/CP–83746			
2	20:22518	*See* ANL/MCS/CP–84761			
3	20:22910	*See* ANL/MCS/CP–84608			
CONF-9502102–		(International workshop on chiral dynamics in hadrons and nuclei; Seoul (Korea, Republic of); 6-10 Feb 1995)			
1	20:22562	*See* BNL–61794			
CONF-950212–		(7. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing; San Francisco, CA (United States); 15-17 Feb 1995)			
8	20:22519	*See* ANL/MCS/CP–85304			
CONF-950216–		(Waste management '95; Tucson, AZ (United States); 26 Feb - 2 mar 1995)			
134	20:20957	*See* WSRC-MS–95-0064			
135	20:20956	*See* WSRC-MS–95-0038			
136	20:21397	*See* PNL-SA–26066			
137	20:20753	*See* ANL/CMT/CP–85710			
138	20:21032	*See* WHC-SA–2746			
139	20:20996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012881	MF-800
140	20:20754	*See* ANL/EA/CP–84132			
143	20:20755	*See* ANL/EA/CP–84317			
144	20:22901	*See* ANL/EA/CP–85661			
145	20:20757	*See* ANL/EA/CP–85519			
146	20:20756	*See* ANL/EA/CP–84357			
147	20:22400	*See* BNL–61615			
148	20:20738	*See* ANL/EA/CP–84161			
CONF-950223–		(3. biennial energy efficiency and the global environment conference: industrial competitiveness and sustainability; Newport Beach, CA (United States); 8-9 Feb 1995)			
2	20:22900	*See* ANL/DIS/CP–84623			
CONF-950226–		(SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine; San Jose, CA (United States); 5-14 Feb 1995)			
39	20:22493	*See* UCRL-JC–120215			
40	20:21852	*See* UCRL-JC–120006			
41	20:22468	*See* UCRL-JC–119377			
42	20:22469	*See* UCRL-JC–120178			
43	20:22113	*See* SAND–94-2002C			
44	20:22366	*See* LA-UR–95-1325			
45	20:21635	*See* SAND–95-8518C			
47	20:21593	*See* SAND–95-8554C			
48	20:21671	*See* SAND–94-8779C			
49	20:21757	*See* LBL–36749			
50	20:21678	*See* ANL/FE/CP–83609			
CONF-950232–		(6. American Nuclear Society meeting on robotics and remote systems; Monterey, CA (United States); 5-10 Feb 1995)			
33	20:20837	*See* UCRL-JC–118906			
35	20:21776	*See* UCRL-JC–117059			
CONF-950240–		(International modal analysis conference; Nashville, TN (United States); 13-16 Feb 1995)			
5	20:21778	*See* UCRL-JC–117457			

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CONF-950256–		(Society of Automotive Engineers international congress and exposition; Detroit, MI (United States); 27 Feb - 2 mar 1995)			
6	20:21536	*See* ANL/ES/CP–85765			
7	20:21530	*See* ANL/ES/CP–85350			
8	20:21526	*See* ANL/ES/CP–85251			
9	20:21529	*See* ANL/ES/CP–85263			
10	20:21533	*See* ANL/ES/CP–85239			
CONF-950261–		(Contribution for Halbach Festschrift; Berkeley, CA (United States); 3 Feb 1995)			
3	20:22776	*See* LBL–36615			
4	20:21988	*See* LBL–36839			
CONF-950276–		(7. Vienna wire chamber conference (WCC-95); Vienna (Austria); 13-17 Feb 1995)			
2	20:22069	*See* ANL-HEP-PR–95-8			
3	20:21965	*See* FNAL/C–95/076-E			
CONF-950283–		(Application of vortex methods to engineering problems forum; Albuquerque, NM (United States); 22-24 Feb 1995)			
3	20:21829	*See* SAND–95-8517C			
CONF-950285–		(LAFEX international school in high energy physics; Rio de Janeiro (Brazil); 20 Feb 1995)			
3	20:22648	*See* FNAL/C–95/049			
CONF-950287–		(International symposium on vector boson interactions; Los Angeles, CA (United States); 1-3 Feb 1995)			
3	20:22582	*See* FNAL/C–95/062-E			
4	20:22630	*See* LBL–37014			
CONF-950288–		(Microstructure and mechanical properties of aging materials; Las Vegas, NV (United States); 12-16 Feb 1995)			
1	20:21604	*See* WSRC-MS–94-0416			
CONF-950291–		(10. target fabrication specialists' meeting; Taos, NM (United States); 6-9 Feb 1995)			
1	20:22894	*See* UCRL-JC–119533			
2	20:22893	*See* UCRL-JC–119390			
CONF-950292–		(NRIM international seminar on superconductors in high magnetic fields; Tsukuba (Japan); 17-18 Feb 1995)			
1	20:22820	*See* ANL/MSD/CP–85925			
CONF-950295–		(National electronic packaging and production conference; Anaheim, CA (United States); 26 Feb - 2 mar 1995)			
1	20:21509	*See* UCRL-JC–119135			
CONF-950296–		(Swiss FACE meeting; Zurich (Switzerland); 2-3 Feb 1995)			
1	20:22162	*See* BNL–61363			
CONF-950297–		(American Chemical Society spring meeting; Anaheim, CA (United States); 2 Feb 1995)			
1	20:21716	*See* SAND–95-0932C			
CONF-950299–		(International symposium on unified symmetry: in the small and in the large; Miami, FL (United States); 2-5 Feb 1995)			
1	20:22554	*See* LA-UR–95-1375			
CONF-950309–		(25. annual conference and exhibition on wind power; Washington, DC (United States); 26-30 Mar 1995)			
7	20:21150	*See* SAND–94-2604C			
CONF-9503104–		(9. symposium on meteorological observations and instrumentation; Charlotte, NC (United States); 27-31 Mar 1995)			
2	20:22154	*See* ANL/ER/CP–84065			
3	20:22155	*See* ANL/ER/CP–84206			
CONF-9503106–		(Goddard conference on mass storage and technolgies; College Park, MD (United States); 28-30 Mar 1995)			
2	20:22953	*See* LBL–36680			
CONF-950311–		(International conference on fuel management and handling; Edinburgh (United Kingdom); 20-22 Mar 1995)			
1	20:20762	*See* ANL/TD/CP–82910			

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2	20:21257	*See* ANL/IFR/CP–82924			
3	20:21233	*See* ANL/ED/CP–85853			
CONF-9503113–		(Automotive laser applications workshop; Dearborn, MI (United States); 6-7 Mar 1995)			
2	20:21489	*See* ANL/TD/CP–85711			
CONF-9503116–		(1995 TOUGH workshop; Berkeley, CA (United States); 20-22 Mar 1995)			
7	20:20806	*See* LBL–36872			
8	20:21811	*See* LBL–36944			
10	20:21812	*See* LBL–37066			
CONF-9503119–		(ECM '95 conference; Las Cruces, NM (United States); 12-15 Mar 1995)			
4	20:21589	*See* SAND–95-0855C			
CONF-9503125–		(9. international conference on microscopy of semiconducting materials; Oxford (United Kingdom); 20-23 Mar 1995)			
2	20:21664	*See* LBL–37086			
CONF-950313–		(20. international technical conference on coal utilization and fuels systems; Clearwater, FL (United States); 20-23 Mar 1995)			
1	20:20598	*See* BNL–61521			
CONF-9503140–		(5. atmospheric radiation measurement (ARM) meeting; San Diego, CA (United States); 20-23 Mar 1995)			
1	20:22161	*See* BNL–60197			
2	20:22327	*See* PNL-SA–25951			
3	20:22240	*See* PNL-SA–26034			
5	20:22157	*See* ANL/ER/CP–86004			
6	20:22244	*See* SAND–95-8556C			
7	20:22158	*See* ANL/ER/CP–86324			
CONF-9503141–		(Annual meeting of Society of Photogrammetry and Remote Sensing; Charlotte, NC (United States); 27 Mar - 2 apr 1995)			
1	20:22977	*See* WSRC-MS–95-0031			
CONF-9503142–		(Workshop on environmental and energy applications of neural networks conference; Richland, WA (United States); 30-31 Mar 1995)			
1	20:22957	*See* PNL-SA–25920			
2	20:21431	*See* PNL-SA–26114			
CONF-9503143–		(Compliance systems for disarmament treaties: a workshop on the promotion and enforcement of international law; Toronto (Canada); 3 Mar 1995)			
1	20:21540	*See* ANL/DIS/CP–85862			
CONF-9503144–		(7. international symposium on integrated ferroelectrics; Colorado Springs, CO (United States); 20-22 Mar 1995)			
1	20:21609	*See* ANL/MSD/CP–84416			
CONF-9503146–		(Ultrafast electronics and optoelectronics symposium; Dana Point, CA (United States); Mar 1995)			
1	20:22112	*See* LBL–36845			
CONF-9503147–		(Rencontres de Physique de la Valle' d'Aoste; La Thuile (Italy); Mar 1995)			
1	20:22581	*See* FNAL/C–95-060-E			
2	20:22565	*See* FNAL/C–95/094			
CONF-9503148–		(Radioactive waste management and space meeting on peaceful disposition on weapon grade materials; Berlin (Germany); 3-9 Mar 1995)			
1	20:20841	*See* UCRL-JC–119874			
CONF-9503149–		(2. chemical analysis by laser interrogation of proliferation effluents (CALIOPE) meeting; Albuquerque, NM (United States); 28-30 Mar 1995)			
1	20:22769	*See* UCRL-JC–119948			
CONF-9503150–		(Thermal barrier coating workshop; Westlake, OH (United States); 27-29 Mar 1995)			
1	20:21523	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012897	MF-1425

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9503152–		(1. Doha conference on natural gas; Doha (Qatar); 13-15 Mar 1995)			
	20:20708	*See* INIS-mf–14540			
CONF-9503155–		(8. national symposium on sensor fusion; Dallas, TX (United States); 15-17 Mar 1995)			
1	20:22122	*See* SAND–95-0453C			
CONF-9503158–		(30. Rencontres de Moriond on QCD and high energy interactions; Les Arcs (France); 19-26 Mar 1995)			
1	20:22588	*See* FNAL/C–95116-E			
2	20:22584	*See* FNAL/C–95/102-E			
4	20:22583	*See* FNAL/C–95/095-E			
5	20:22585	*See* FNAL/C–95/106-E			
6	20:22586	*See* FNAL/C–95/133-E			
8	20:22587	*See* FNAL/C–95/137-E			
CONF-9503161–		(7. annual Gulf Coast environmental conference; Houston, TX (United States); 9 Mar 1995)			
1	20:22261	*See* ANL/ES/CP–85635			
CONF-950317–		(Symposium on optimization of mechanical systems; Stuttgart (Germany); 26-31 Mar 1995)			
1	20:22911	*See* ANL/MCS/CP–86364			
CONF-950333–		(2. SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment; Houston, TX (United States); 27-29 Mar 1995)			
2	20:22399	*See* ANL/EA/CP–83892			
CONF-950336–		(American Society of Mechanical Engineers/Japanese Society of Mechanical Engineers/Japan Solar Energy Society international solar energy conference; Lahaina, HI (United States); 19-24 Mar 1995)			
25	20:21123	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011598	MF-1302
CONF-950381–		(11. symposium on boundary layers and turbulence; Charlotte, NC (United States); 27-31 Mar 1995)			
3	20:22153	*See* ANL/ER/CP–84064			
4	20:22156	*See* ANL/ER/CP–84929			
CONF-950397–		(Joint DOE/EPRI international conference on cost-effective instrumentation and control technology upgrades for nuclear power plants; Nashville, TN (United States); 22-24 Mar 1995)			
1	20:21236	OSTI; INIS; NTIS; GPO Dep.	E 1.99:	DE95012868	MF-400
CONF-950401–		(97. annual meeting of the American Ceramic Society; Cincinnati, OH (United States); 30 Apr - 1 may 1995)			
5	20:21066	*See* LA-UR–95-1486			
8	20:21328	*See* ANL/CMT/CP–84744			
9	20:21101	*See* ANL/ET/CP–84639			
CONF-950402–		(209. American Chemical Society (ACS) national meeting; Anaheim, CA (United States); 2-6 Apr 1995)			
9-Vugraphs	20:22341	*See* ANL/CMT-ACL/VU–84890			
CONF-9504108–		(4. international workshop on software engineering, artificial intelligence and expert systems for high-energy and nuclear physics; Pisa (Italy); 3-8 Apr 1995)			
1	20:22524	*See* FNAL/C–95/065			
CONF-950412–		(Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995)			
9	20:21450	*See* LA-UR–95-1359			
10	20:21070	*See* LA-UR–95-1370			
11	20:21333	*See* LBL–37071			
12	20:21634	*See* SAND–95-0936C			
13	20:22100	*See* LBL–37096			
14	20:21644	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012888	MF-404
17	20:21608	*See* ANL/ET/CP–84592			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
18	20:21560	*See* UCRL-JC--120324			
CONF-9504132--		(Spring workshop on basic science using pulsed power; Santa Barbara, CA (United States); 5-7 Apr 1995)			
4	20:21756	*See* LA-UR--95-1336			
CONF-9504134--		(HAZMACON '95: hazardous materials management conference and exhibition; San Jose, CA (United States); 4-6 Apr 1995)			
5	20:22353	*See* UCRL-JC--118909			
CONF-9504137--		(SPIE: aero sense conference; San Francisco, CA (United States); 17-21 Apr 1995)			
2	20:20818	*See* PNL-SA--24937			
CONF-950414--		(57. annual American power conference; Chicago, IL (United States); 18-20 Apr 1995)			
2	20:21108	*See* ANL/DIS/CP--85855			
3	20:20574	*See* ANL/ES/CP--86103			
CONF-9504141--		(Advanced techniques in catalyst preparations syposium; Anaheim, CA (United States); 2-7 Apr 1995)			
2	20:21714	*See* PNL-SA--25493			
CONF-9504144--		(AusWeb '95: 1. Austrialian WWW conference; New South Wales (Australia); 29 Apr - 2 may 1995)			
1	20:22950	*See* FNAL/C--95/056			
CONF-9504145--		(Fluid dynamics international (FIDAP) users conference; Chicago, IL (United States); 30 Apr - 2 may 1995)			
2	20:20763	*See* ANL/TD/CP--86243			
CONF-9504150--		(Utility renewable energy planning and modeling workshop; Newton, MA (United States); 19-20 Apr 1995)			
	20:21518	*See* NREL/CP--462-7900			
CONF-9504154--		(Symposium on autonomous vehicles in mine countermeasures; Monterey, CA (United States); 3-7 Apr 1995)			
1	20:22136	*See* UCRL-JC--119069			
2	20:22116	*See* UCRL-JC--120534			
CONF-9504155--		(38. annual technical conference of the Society of Vacuum Coaters; Chicago, IL (United States); 2-7 Apr 1995)			
1	20:21784	*See* UCRL-JC--120508			
2	20:21669	*See* PNL--SA-25926			
CONF-9504156--		(Research Assistant Task Force conference; Charlotte, NC (United States); 11-13 Apr 1995)			
1	20:21588	*See* PNL-SA--26120			
CONF-9504157--		(Combined optical-microwave earth and atmosphere conference; Atlanta, GA (United States); 3-6 Apr 1995)			
1	20:22243	*See* SAND--95-8519C			
CONF-9504158--		(CAD/CAE conference; Atlanta, GA (United States); 19 Apr 1995)			
1	20:21725	*See* ANL/ED/CP--86110			
2	20:22967	*See* UCRL-JC--120716			
3	20:22458	*See* LA-UR--95-1305			
CONF-9504160--		(1995 DOE/NREL hydrogen program review; Coral Gables, FL (United States); 18-21 Apr 1995)			
2	20:21067	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012842	MF-1360
3	20:21531	*See* UCRL-JC--120151			
CONF-9504163--		(Combustion Institute and American Flame Research onference; San Antonio, TX (United States); 23-26 Apr 1995)			
1	20:21524	*See* SAND--95-8563C			
2	20:22130	*See* SAND--95-8587C			
3	20:21724	*See* UCRL-JC--120938			

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CONF-9504164--		(Global '95; Roane/Anderson Professional Society meeting; Versailles (France); Oak Ridge, TN (United States); 11 Sep 1995; 12 apr 1995)			
1	20:21297	*See* CONF-9509162--1			
CONF-9504165--		(12. international workshop on ECR ion sources; Riken (Japan); 25-27 Apr 1995)			
1	20:21941	*See* ANL/PHY/CP--86382			
CONF-9504168--		(Department of Energy/Electric Power Research Institute/National Institute of Standards and Technology (DOE/EPRI/NIST) workshop; Charlotte, NC (United States); 11-13 Apr 1995)			
1	20:21569	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013046	MF-404
CONF-9504171--		(21. annual environmental symposium of the American Defense Preparedness Association; San Diego, CA (United States); 18-21 Apr 1995)			
1	20:22149	*See* ANL/EA/CP--84361			
CONF-950420--		(International conference on mathematics and computations, reactor physics, and environmental analyses; Portland, OR (United States); 30 Apr - 4 may 1995)			
24	20:22373	*See* UCRL-JC--118744			
26	20:21219	*See* ANL/RA/CP--85371			
Handbk	20:21234	*See* ANL/RA/CP--84091			
CONF-950426--		(3. international conference on nuclear engineering; Kyoto (Japan); 23-27 Apr 1995)			
3	20:21292	*See* BNL--61649			
CONF-950430--		(5. ANS topical meeting on emergency preparedness and response; Savannah, GA (United States); 18-21 Apr 1995)			
5	20:22251	*See* UCRL-JC--119134			
CONF-950435--		(2. international conference on mechanics of jointed and faulted rock; Vienna (Austria); 10-14 Apr 1995)			
2	20:20835	*See* UCRL-JC--116418			
CONF-950439--		(SMS simulation multiconference: simulation as a critical technology; Phoenix, AZ (United States); 9-13 Apr 1995)			
11	20:22956	*See* PNL-SA--25658			
14	20:21699	*See* ANL/CMT/CP--85232			
CONF-950445--		(2. international conference on multiphase flow; Kyoto (Japan); 3-7 Apr 1995)			
3	20:21794	*See* ANL/IFR/CP--85915			
CONF-950450--		(8. annual symposium on the application of geophysics to environmental and engineering problems; Orlando, FL (United States); 23-27 Apr 1995)			
8	20:22260	*See* ANL/ER/CP--86429			
9	20:22497	*See* ANL/ES/CP--85471			
CONF-950451--		(21. national environmental symposium and exhibition; San Diego, CA (United States); 17-21 Apr 1995)			
3	20:21346	*See* ANL/EA/CP--85912			
CONF-950454--		(22. international AVS conference on metallurgical coatings and thin films; San Diego, CA (United States); 24-28 Apr 1995)			
1	20:21780	*See* UCRL-JC--118757			
2	20:21628	*See* PNL-SA--25315			
3	20:21640	*See* ANL/ET/CP--85882			
5	20:21639	*See* ANL/CHM/CP--86016			
CONF-950472--		(SPIE international symposium on aerospace/defense sensing and dual-use photonics; Orlando, FL (United States); 17-21 Apr 1995)			
7	20:22250	*See* UCRL-JC--118707			
CONF-950476--		(12. international conference on laser interaction and related plasma phenomena; Osaka (Japan); 24-28 Apr 1995)			
1	20:22851	*See* LA-UR--95-1333			

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2	20:22881	*See* LA-UR--95-1350			
3	20:22880	*See* LA-UR--95-1306			
4	20:21851	*See* UCRL-JC--119202			
CONF-950478--		(International conference on nuclear spectroscopy and nuclear structure; Dubna (Russian Federation); 4-7 Apr 1995)			
1	20:22762	*See* LA-UR--95-1341			
CONF-950494--		(Natural gas research, development and demonstration contractors review meeting; Baton Rouge, LA (United States); 4-6 Apr 1995)			
5	20:20696	*See* DOE/MC/30086--95/C0458			
6	20:20697	*See* DOE/MC/30139--95/C0457			
7	20:20695	*See* DOE/MC--28176-95/C0468			
8	20:20704	*See* DOE/MC/30070--95/C0470			
9	20:20723	*See* DOE/MC/31113--95/C0471			
10	20:20699	*See* DOE/MC/31182--95/C0479			
12	20:21104	*See* DOE/MC/29228--95/C0462			
13	20:20702	*See* DOE/MC--29252-95/C0460			
14	20:21103	*See* DOE/MC--26029-95/C0461			
16	20:20705	*See* DOE/MC/32073--95/C0464			
17	20:20703	*See* DOE/MC/29470--95/C0466			
18	20:20701	*See* DOE/MC/28178--95/C0467			
20	20:21682	*See* DOE/MC/27115--95/C0478			
21	20:21102	*See* DOE/MC--00098-95/C0463			
23	20:20605	*See* DOE/MC/29078--95/C0469			
CONF-950495--		(7. national technology information exchange workshop; Cincinnati, OH (United States); 18-20 Apr 1995)			
1	20:21023	*See* PNL-SA--25501			
2	20:22899	*See* ANL/CMT-ACL/CP--85835			
CONF-950505--		(5. topical meeting on tritium technology in fission, fusion and isotopic applications; Ispra (Italy); 28 May - 3 jun 1995)			
14	20:22875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013217	MF-424
CONF-9505101--		(Conference on challenges and innovations in the management of hazardous waste; Washington, DC (United States); 10-12 May 1995)			
3	20:20994	*See* ANL/EMO/CP--86349			
4	20:21034	*See* WHC-SA--2841			
CONF-9505111--		(11. pollution prevention conference: shaping the future through pollution prevention involvement - commitment - progress; Knoxville, TN (United States); 16-18 May 1995)			
1	20:20748	*See* ANL/CMT-ACL/CP--85238			
2	20:20854	*See* WHC-SA--2768			
3	20:20853	*See* WHC-SA--2761			
CONF-950512--		(Particle accelerator conference; Dallas, TX (United States); 1-5 May 1995)			
100	20:21844	*See* SLAC-PUB--95-6885			
101	20:22000	*See* SLAC-PUB--95-6892			
102	20:22055	*See* BNL--61787			
103	20:21977	*See* LA-UR--95-1450			
104	20:21835	*See* LA-UR--95-1502			
105	20:21864	*See* LA-UR--95-1507			
106	20:21978	*See* LA-UR--95-1501			
107	20:21865	*See* LA-UR--95-1508			
108	20:21979	*See* LA-UR--95-1506			
109	20:20804	*See* LA-UR--95-1509			
110	20:21990	*See* LBL--36950			
125	20:21899	*See* BNL--61788			
126	20:21966	*See* FNAL/C--95/087			
127	20:22002	*See* SLAC-PUB--95-6910			
129	20:22001	*See* SLAC-PUB--95-6909			
133	20:21919	*See* SLAC-PUB--95-6905			
135	20:21916	*See* SLAC-PUB--95-6850			
136	20:21870	*See* SLAC-PUB--95-6849			
137	20:22054	*See* BNL--61225			
138	20:21895	*See* BNL--61188			
142	20:21896	*See* BNL--61189			
143	20:21955	*See* BNL--61224			
145	20:22516	*See* LA-UR--95-1540			

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147	20:21908	*See* LA-UR–95-1547			
148	20:21980	*See* LA-UR–95-1548			
149	20:21981	*See* LA-UR–95-1553			
151	20:22097	*See* LA-UR–95-1564			
152	20:21866	*See* LA-UR–95-1566			
154	20:21958	*See* BNL–61264			
155	20:21957	*See* BNL–61234			
156	20:21956	*See* BNL–61226			
157	20:21868	*See* SAND–95-0915C			
158	20:21905	*See* FNAL/C–95/122			
159	20:21902	*See* FNAL/C–95/097			
160	20:21903	*See* FNAL/C–95/098			
161	20:21890	*See* ANL/ASD/CP–85027			
164	20:21942	*See* ANL/XFD/CP–84868			
165	20:21937	*See* ANL/ASD/CP–84937			
170	20:21889	*See* ANL/ASD/CP–85013			
175	20:21940	*See* ANL-HEP-CP–95-34			
180	20:21856	*See* ANL/ASD/CP–85006			
181	20:21888	*See* ANL/ASD/CP–85002			
183	20:21959	*See* BNL–61847			
185	20:22065	*See* SLAC-PUB–95-6797			
186	20:22059	*See* SLAC–95-6788			
187	20:21915	*See* SLAC-PUB–95-6804			
189	20:21995	*See* SLAC-PUB–95-6813			
190	20:21997	*See* SLAC-PUB–95-6842			
191	20:21992	*See* SLAC-PUB–95-6787			
192	20:21998	*See* SLAC-PUB–95-6848			
193	20:21994	*See* SLAC-PUB–95-6790			
194	20:21993	*See* SLAC-PUB–95-6789			
196	20:22064	*See* SLAC-PUB–95-6795			
197	20:21914	*See* SLAC-PUB–95-6792			
200	20:21996	*See* SLAC-PUB–95-6826			
201	20:21862	*See* FNAL/C–95/123			
202	20:22056	*See* FNAL/C–95/100			
203	20:21967	*See* FNAL/C–95/105			
205	20:21858	*See* ANL/PHY/CP–85475			
207	20:21936	*See* ANL/ASD/CP–84873			
208	20:21891	*See* ANL/ASD/CP–85054			
209	20:21892	*See* ANL/PHY/CP–85477			
210	20:21960	*See* BNL–61878			
211	20:21904	*See* FNAL/C–95/104			
212	20:21968	*See* FNAL/C–95/124			
215	20:21897	*See* BNL–61496			
216	20:21969	*See* FNAL/C–95/145			
218	20:21857	*See* ANL/ASD/CP–85047			
221	20:21855	*See* ANL/ASD/CP–84988			
222	20:21938	*See* ANL/ASD/CP–85095			
92	20:21976	*See* LA-UR–95-1210			
93	20:21728	*See* ANL/TD/CP–84983			
94	20:22066	*See* SLAC-PUB–95-6886			
95	20:22067	*See* SLAC-PUB–95-6887			
96	20:21918	*See* SLAC-PUB–95-6888			
97	20:22104	*See* SLAC-PUB–95-6890			
98	20:21999	*See* SLAC-PUB–95-6891			
99	20:21917	*See* SLAC-PUB–95-6881			
CONF-9505121–		(45. electronic components and technology conference; Las Vegas, NV (United States); 22-26 May 1995)			
3	20:22958	*See* SAND–95-0753C			
CONF-9505127–		(1. industrial energy efficiency symposium and exposition; Washington, DC (United States); 1-3 May 1995)			
Summ.	20:21381	*See* ANL/ES/CP–86457			
CONF-950514–		(World geothermal congress: worldwide utilization of geothermal energy; Florence (Italy); 18-31 May 1995)			
12	20:21142	*See* LBL–36849			
13	20:21133	*See* LBL–36873			
CONF-9505155–		(9. international heat pipe conference; Albuquerque, NM (United States); 1-5 May 1995)			
2	20:21132	*See* SAND–94-2059C			

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CONF-950518–		(187. meeting of the Electrochemical Society; Reno, NV (United States); 21-26 May 1995)			
5	20:21841	*See* SAND–95-1108C			
9	20:21638	*See* ANL/CHM/CP–85655			
10	20:22873	*See* ANL/ET/CP–84955			
11	20:21837	*See* SAND–95-0084C			
CONF-9505186–		(2. physical phenomena at high magnetic fields conference; Tallahassee, FL (United States); 6-9 May 1995)			
1	20:21656	*See* LA-UR–95-1555			
2	20:21586	*See* LA-UR–95-1320			
CONF-9505192–		(4. international symposium on diamond materials; Reno, NV (United States); 21-26 May 1995)			
2	20:21637	*See* ANL/CHM/CP–85037			
CONF-9505195–		(Nuclear criticality technology and safety project (NCTSP) annual meeting; San Diego, CA (United States); 17 May 1995)			
4	20:22926	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013218	MF-605
5	20:21730	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013216	MF-610
CONF-9505196–		(1995 industrial and commercial power systems conference; San Antonio, TX (United States); 8-10 May 1995)			
2	20:21322	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008974	MF-406
CONF-9505204–		(9, annual conference on fossil energy materials; Oak Ridge, TN (United States); 16-18 May 1995)			
1	20:21633	*See* SAND–95-0934C			
3	20:20584	*See* ANL/ET/CP–86087			
CONF-9505205–		(5. major Range and Test Facility Base environmental workshop; Alexandria, VA (United States); 23-25 May 1995)			
2	20:20803	*See* LA-UR–95-1270			
CONF-9505207–		(Regional seminar on the national implementation of the chemical weapons convention; Yamoussoukro (South Africa); 9 May 1995)			
1	20:21542	*See* ANL/DIS/CP–86455			
2	20:21541	*See* ANL/DIS/CP–86454			
CONF-9505208–		(Pacific basin conference on hazardous waste; Alberta (Canada); 7-12 May 1995)			
1	20:21347	*See* ANL/EA/CP–86430			
CONF-9505210–		(DL '95 conference; Washington, DC (United States); 15-19 May 1995)			
1	20:22974	*See* PNL-SA–25720			
CONF-9505211–		(DOE Council on Materials conference on new directions for ion beams in semiconductor processing; Santa Fe, NM (United States); 4-7 May 1995)			
1	20:21838	*See* SAND–95-0794C			
2	20:21673	*See* SAND–95-0979C			
CONF-9505212–		(ILASS Americas '95: 8. annual conference on liquid atomization and spray system; Troy, MI (United States); 21-24 May 1995)			
1	20:21592	*See* SAND–95-8551C			
CONF-9505213–		(International conference on induction hardened gears and precision components; Indianapolis, IN (United States); 15-17 May 1995)			
1	20:21506	*See* SAND–94-1199C			
CONF-9505214–		(Silicon Valley ergonomics conference; San Jose, CA (United States); 21-22 May 1995)			
1	20:22496	*See* UCRL-JC–120472			
CONF-9505215–		(1995 American Society of Civil Engineers water resources and management conference; Boston, MA (United States); 7-10 May 1995)			
1	20:22342	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013215	MF-402
CONF-9505216–		(US/Japan workshop on atomic scale mechanisms of epitaxial growth; Honolulu, HI (United States); 10-12 May 1995)			
1	20:21672	*See* SAND–95-0848C			

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CONF-9505219–		(3. international conference on laser ablation (COLA '95); Strasbourg (France); 22-26 May 1995)			
1	20:21645	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012884	MF-404
CONF-9505220–		(1. international Institute of Electrical and Electronic Engineers (IEEE) symposium on intelligence in neural and biological systems; Hendron, VA (United States); 23-25 May 1995)			
1	20:22358	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013042	MF-407
CONF-9505222–		(1995 monitoring technologies conference; Chantilly, VA (United States); 15-18 May 1995)			
1	20:22506	*See* UCRL-JC–120952			
CONF-9505223–		(17. DOE Computer Security Group training conference; Germantown, MD (United States); 8-11 May 1995)			
1	20:22908	*See* ANL/ECT/CP–85500			
CONF-9505229–		(45. annual bomb and warhead technical symposium; Huntsville, AL (United States); 16-17 May 1995)			
1	20:22137	*See* UCRL-JC–119203			
CONF-950534–		(Conference on real-time computer applications in nuclear, particle and plasma physics (RT); East Lansing, MI (United States); 22-26 May 1995)			
1	20:22076	*See* FNAL/C–95/110			
2	20:21939	*See* ANL/ASD/CP–86682			
CONF-950540–		(15. conference on lasers and electro-optics and 5th quantum electronics and laser science conference; Baltimore, MD (United States); 21-26 May 1995)			
10	20:22892	*See* UCRL-JC–119004			
CONF-950542–		(14. international symposium on thermal treatment technologies: incineration conference; Seattle, WA (United States); 8-12 May 1995)			
2	20:20752	*See* ANL/CMT/CP–85474			
CONF-950550–		(13. aerodynamics decelerator systems technology conference; Clearwater, FL (United States); 15-19 May 1995)			
3	20:21726	*See* SAND–94-2287C			
4	20:21816	*See* SAND–94-2471C			
CONF-950564–		(9. symposium on power plant dynamics, control and testing; Knoxville, TN (United States); 24-26 May 1995)			
5	20:21223	*See* ANL/IFR/CP–84089			
CONF-950569–		(6. ASTM symposium on composites: fatigue and fracture; Denver, CO (United States); 16-18 May 1995)			
1	20:21822	*See* SAND–95-8530C			
CONF-950570–		(International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995)			
18	20:20839	*See* UCRL-JC–119121			
19	20:20840	*See* UCRL-JC–119724			
20	20:20838	*See* UCRL-JC–119106			
22	20:20805	*See* LBL–36386			
23	20:20997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012996	MF-802
25	20:20772	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012255	MF-814
28	20:20750	*See* ANL/CMT/CP–84720			
29	20:20758	*See* ANL/EA/SUMM–84815			
30	20:20759	*See* ANL/RA/SUMM–85653			
31	20:20751	*See* ANL/CMT/CP–84882			
CONF-950584–		(Annual meeting of the Society of Tribologists and Lubrication Engineers; Chicago, IL (United States); 14-18 May 1995)			
1	20:21607	*See* ANL/ET/CP–84391			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950585–		(13. NREL photovoltaics program review meeting: Lakewood, CO (United States); 16-19 May 1995)			
2	20:21119	*See* NREL/TP–411-8006			
CONF-950587–		(17. symposium on biotechnology for fuels and chemicals; Vail, CO (United States); 7-11 May 1995)			
Absts.	20:21080	*See* NREL/SP–420-7849			
CONF-950601–		(Annual meeting of the American Nuclear Society (ANS); Philadelphia, PA (United States); 25-29 Jun 1995)			
12	20:21258	*See* ANL/TD/SUMM–85849			
13	20:20734	*See* ANL/CMT/SUMM–85376			
CONF-950610–		(Power electronics specialist conference; Atlanta, GA (United States); 12-15 Jun 1995)			
1	20:21831	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009695	MF-1411
CONF-950612–		(22. international conference on plasma science; Madison, WI (United States); 5-8 Jun 1995)			
1	20:22871	*See* UCRL-JC–121089			
CONF-9506121–		(7. international symposium on nuclear reactor surveillance and diagnostics; Avignon (France); 19-23 Jun 1995)			
1	20:21295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012846	MF-405; MF-413
2	20:21235	*See* ANL/RA/CP–84204			
CONF-9506126–		(Conference on nondestructive evaluation of aging infrastructure; Oakland, CA (United States); 6-8 Jun 1995)			
4	20:21825	*See* UCRL-JC–120505			
CONF-9506142–		(4. international symposium on behavior of dense media under high dynamic pressure; Tours (France); 5-9 Jun 1995)			
2	20:22135	*See* UCRL-JC–117805			
CONF-9506144–		(5. international conference on numerical methods in industrial forming processes (NUMIFORM); Ithaca, NY (United States); 18-21 Jun 1995)			
2	20:21602	*See* UCRL-JC–119951			
3	20:21600	*See* UCRL-JC–117773			
4	20:21782	*See* UCRL-JC–119862			
6	20:21585	*See* LA-UR–95-1319			
8	20:21591	*See* SAND–95-8507C			
CONF-9506150–		(2. annual Department of Energy defense programs packaging workshop; San Francisco, CA (United States); 12-15 Jun 1995)			
1	20:21772	*See* SAND–95-1001C			
2	20:21771	*See* SAND–95-0969C			
3	20:21766	*See* RFP–4999			
4	20:21790	*See* WSRC-MS–95-0197			
5	20:20855	*See* WHC-SA–2777			
CONF-9506176–		(19. annual actinide separations conference; Monterey, CA (United States); 12-15 Jun 1995)			
summ.	20:21561	*See* ANL/CMT/AV–86434			
CONF-9506177–		(Window innovations conference; Toronto (Canada); 8-9 Jun 1995)			
1	20:21467	*See* LBL–36896			
2	20:21469	*See* LBL–37024			
CONF-9506178–		(International Association of Science and Technology for Development conference on robotics and manufacturing; Cancun (Mexico); 14-17 Jun 1995)			
1	20:21046	*See* WSRC-MS–94-0628			
2	20:22372	*See* SAND–95-1123C			
CONF-9506179–		(1995 international conference on integrated optics and optical fibre communications; Tokyo (Japan); 26-30 Jun 1995)			
1	20:22895	*See* UCRL-JC–120517			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9506181–		(Micromechanics and constitutive modeling of composite materials; Los Angeles, CA (United States); 28-30 Jun 1995)			
1	20:21654	*See* LA-UR–95-1168			
CONF-9506182–		(NEPCON East '95; Boston, MA (United States); 12-15 Jun 1995)			
1	20:22247	*See* UCRL-JC–117424			
CONF-9506183–		(Optics for environmental and public safety; Munich Bavaria (Germany); 19-23 Jun 1995)			
1	20:22271	*See* DOE/MC–29103-95/C0459			
CONF-9506184–		(Society of Women Engineers national meeting; Boston, MA (United States); 27 Jun - 1 jul 1995)			
1	20:22371	*See* SAND–95-0747C			
2	20:21453	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012874	MF-1600
CONF-9506185–		(New tools for neutron instrumentation workshop; Les Houches (France); 6-10 Jun 1995)			
1	20:22072	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012841	MF-406
CONF-9506188–		(International coloquium on automata languages (ICALP '95); Szeged (Hungary); Jun 1995)			
1	20:22952	*See* LA-UR–95-1411			
CONF-9506192–		(Transducers '95; Stockholm (Sweden); 25-29 Jun 1995)			
1	20:22362	*See* UCRL-JC–120812			
2	20:22121	*See* SAND–95-1144C			
CONF-9506194–		(1995 PVP conference; Livermore, CA (United States); 12-14 Jun 1995)			
1	20:21789	*See* WSRC-MS–95-0116			
CONF-9506196–		(ISER 95: 4. international symposium on experimental bobotics; Stanford, CA (United States); 30 Jun - 2 jul 1995)			
1	20:21773	*See* SAND–95-1192C			
CONF-9506197–		(International colloquium on plasma processes; Antibes-Juan-les-Pins (France); 11-15 Jun 1995)			
1	20:21559	*See* ANL/MSD/CP–86321			
CONF-950634–		(26. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference; San Diego, CA (United States); 19-22 Jun 1995)			
1	20:21810	*See* LA-UR–95-1145			
CONF-950637–		(International workshop on superconductivity: controlled processing of high temperature superconductors - fundamentals and applications; Maui, HI (United States); 18-21 Jun 1995)			
1	20:21616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012871	MF-404
2	20:21617	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013049	MF-1391
3	20:22819	*See* ANL/ET/CP–86117			
CONF-950643–		(7. national demand-side management conference: delivering customer value; Dallas, TX (United States); 28-30 Jun 1995)			
1	20:21422	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012883	MF-1322
2	20:21412	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013208	MF-1322
CONF-950645–		(Air and Waste Management Association meeting; San Antonio, TX (United States); 18-23 Jun 1995)			
12	20:21168	*See* BNL–61542			
18	20:20773	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012892	MF-402; MF-404; MF-406
20	20:21349	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013214	MF-402
21	20:20774	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013048	MF-2010
22	20:21161	*See* ANL/ES/CP–84453			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950650–		(8. international conference on solid-state sensors and actuators and 9th biannual international conference and annual European conference on solid-state sensors; Stockholm (Sweden); 25-29 Jun 1995)			
1	20:21836	*See* SAND–94-3205C			
2	20:21839	*See* SAND–95-0851C			
3	20:22120	*See* SAND–95-0854C			
4	20:21695	*See* SAND–94-3162C			
CONF-950669–		(DOE records management conference: El Camino Real to the year 2000; Albuquerque, NM (United States); 27-30 Jun 1995)			
1	20:22905	*See* FEMP–2425			
2	20:22903	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013973	MF-2000
CONF-950682–		(4. international conference on trends in welding research; Gatlinburg, TN (United States); 5-9 Jun 1995)			
1	20:21767	*See* SAND–94-2748C			
CONF-950690–		(Laboratory safety and environmental management; Baltimore, MD (United States); 27-28 Jun 1995)			
1	20:20749	*See* ANL/CMT-ACL/CP–85503			
CONF-950691–		(14. international conference on magnet technology; Tampere (Finland); 11-16 Jun 1995)			
1	20:21326	*See* ANL/ET/CP–85212			
CONF-9507120–		(Mountain meteorology; Breckenridge, CO (United States); 17-21 Jul 1995)			
3	20:22199	*See* LA-UR–95-1353			
CONF-9507122–		(CLEO/Pacific Rim coal conference; Makuhar (Japan); 11-14 Jul 1995)			
1	20:21843	*See* SAND–95-8512C			
CONF-9507123–		(1995 symposium on combinatorial pattern matching; Helsinki (Finland); 4-7 Jul 1995)			
1	20:22357	*See* SAND–95-0831C			
CONF-9507124–		(15. Congress of the International Society of Biomechanics; Jyvaskyla (Finland); 2-6 Jul 1995)			
1	20:22375	*See* UCRL-JC–119789			
CONF-9507125–		(BEM 17: Boundary element methods; Madison, WI (United States); 17-19 Jul 1995)			
1	20:21818	*See* SAND–95-0829C			
CONF-9507126–		(Nuclear theory town meeting; Argonne, IL (United States); 20-30 Jul 1995)			
1	20:22563	*See* DOE/ER/40561–176			
CONF-9507128–		(IABEM '95: international symposium on boundary element methods; No City Given, HI (United States); Jul 1995)			
1	20:21570	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012890	MF-404; MF-405; MF-704; MF-705
CONF-9507132–		(Symposium on parallel algorithms and architectures; Santa Barbara, CA (United States); 17-19 Jul 1995)			
1	20:22959	*See* SAND–95-1083C			
CONF-9507133–		(Planning for a responsible 21st century; Boston, MA (United States); 30 Jul - 2 aug 1995)			
1	20:21498	*See* KCP–613-5632			
CONF-950716–		(32. annual IEEE international nuclear and space radiation effects conference; Madison, WI (United States); 17-21 Jul 1995)			
2	20:22103	*See* SAND–95-1087C			
CONF-950720–		(AIAA/SAE/ASME joint propulsion conference and exhibit; San Diego, CA (United States); 10-12 Jul 1995)			
3	20:22128	*See* SAND–94-2787C			
4	20:22129	*See* SAND–94-2862C			

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CONF-950725–		(SOLAR '95: national solar energy conference: 10,000 solutions - paths to a renewable future; Minneapolis, MN (United States); 15-20 Jul 1995)			
2	20:21121	*See* SAND–95-0904C			
CONF-950729–		(30. Intersociety energy conversion conference; Orlando, FL (United States); 30 Jul - 5 aug 1995)			
3	20:21603	*See* UCRL-JC–120255			
4	20:21209	*See* SAND–95-0903C			
5	20:21334	*See* NREL/TP–473-7783			
6	20:21122	*See* SAND–95-1082C			
CONF-950740–		(Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995)			
34	20:20767	*See* BNL–61651			
35	20:21785	*See* UCRL-JC–120583			
36	20:22963	*See* UCRL-JC–118794			
37	20:22334	*See* UCRL-JC–119435			
38	20:20766	*See* BNL–61648			
39	20:21033	*See* WHC-SA–2792			
40	20:20851	*See* WHC-SA–2616			
42	20:21224	OSTI; NTIS; INIS		TI95012879	
43	20:22499	*See* BNL-NUREG–61664			
44	20:22498	*See* BNL–61504			
47	20:21225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013203	
62	20:21826	*See* ANL/ET/CP–85778			
63	20:20760	*See* ANL/RE/CP–85929			
64	20:20761	*See* ANL/RE/CP–85952			
CONF-950787–		(36. annual meeting of the Institute for Nuclear Materials Management; Palm Desert, CA (United States); 9-12 Jul 1995)			
2	20:21605	*See* WSRC-MS–95-0033			
CONF-950804–		(13. international conference on structural mechanics in reactor technology; Porto Alegre (Brazil); 13-18 Aug 1995)			
3	20:21226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012298	MF-404
CONF-9508127–		(2. international conference on high temperature ceramic matrix composites; Santa Barbara, CA (United States); 21-25 Aug 1995)			
1	20:21618	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012873	MF-404
CONF-9508133–		(Coal liquefaction and gas conversion contractor review meeting; Pittsburgh, PA (United States); 29-31 Aug 1995)			
1	20:20569	*See* SAND–95-2138C			
CONF-950817–		(7. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-25 Aug 1995)			
1	20:21423	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012882	MF-1322
3	20:21424	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013994	MF-1321
CONF-950820–		(11. international conference on the electronic properties of two dimensional systems; Nottingham (United Kingdom); 7-11 Aug 1995)			
1	20:21646	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012885	MF-404
2	20:21842	*See* SAND–95-1193C			
CONF-950828–		(National heat transfer conference; Portland, OR (United States); 5-9 Aug 1995)			
9	20:21817	*See* SAND–95-0750C			
10	20:22329	*See* SAND–95-1007C			
CONF-950840–		(International conference on applications of diamond films and related materials; Gaithersburg, MD (United States); 21-24 Aug 1995)			
1	20:21840	*See* SAND–95-0998C			
CONF-950846–		(American Physical Society biennial conference on shock compression of condensed matter; Seattle, WA (United States); 13-18 Aug 1995)			
1	20:21557	*See* SAND–95-1191C			

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CONF-950853–		(ASME/JSME annual summer meeting of the Fluids Engineering conference; Hilton Head, SC (United States); 13-17 Aug 1995)			
1	20:21601	*See* UCRL-JC–117980			
1-Rev.1	20:21779	*See* UCRL-JC–117980-Rev.1			
CONF-950865–		(29. annual meeting of the Microbeam Analysis Society; Breckenridge, CO (United States); 6-11 Aug 1995)			
1	20:21679	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012849	MF-404
2	20:21647	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012850	MF-404
3	20:22788	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012866	MF-401
CONF-950875–		(International symposium on plasma chemistry; Minneapolis, MN (United States); 21-25 Aug 1995)			
3	20:21783	*See* UCRL-JC–120410			
CONF-950877–		(3. American Society for Mechanical Engineers biannual mixed waste symposium; Baltimore, MD (United States); 7-11 Aug 1995)			
7	20:21781	*See* UCRL-JC–118897			
8	20:20836	*See* UCRL-JC–118898			
10	20:20991	*See* WSRC-TR–94-0545			
11	20:20958	*See* WSRC-MS–95-0138			
CONF-950892–		(53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995)			
2	20:21680	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012843	MF-406; MF-411
3	20:21571	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012847	MF-404
4	20:21572	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012848	MF-404; MF-1425
8	20:21534	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012894	MF-1505
CONF-950904–		(7. international meeting on nuclear reactor thermal hydraulics; Saratoga, NY (United States); 10-15 Sep 1995)			
1	20:21319	*See* WSRC-MS–94-0356			
2	20:21194	*See* ANL/RA/CP–83070			
3	20:21255	*See* LA-UR–95-926			
4	20:21296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009181	MF-410
5	20:21293	*See* BNL-NUREG–60573			
CONF-9509100–		(5. international conference on nuclear criticality safety; Albuquerque, NM (United States); 17-22 Sep 1995)			
1	20:21792	*See* WSRC-TR–94-0606			
CONF-9509101–		(8. international symposium on polarized phenomena in nuclear physics (SPIN 94); Bloomington, IN (United States); 15-22 Sep 1995)			
1	20:22646	*See* BNL–61419			
CONF-9509118–		(Modeling of casting, welding and advanced solidification processes 7; London (United Kingdom); 10-15 Sep 1995)			
1	20:21768	*See* SAND–95-0503C			
2	20:21821	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010221	MF-405; MF-404
5	20:21573	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012299	MF-404
CONF-9509119–		(1995 New Mexico Geological Society fall field conference; Santa Fe, NM (United States); 25-29 Sep 1995)			
1	20:22504	*See* LA-UR–95-887			
CONF-9509120–		(Air pollution '95; Porto Cerras (Greece); 26-28 Sep 1995)			
1	20:22198	*See* LA-UR–95-1077			
CONF-9509121–		(Characterizations of long term geological changes being considered for disposal sites; Paris (France); 19-21 Sep 1995)			
1	20:22264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009558	MF-814

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CONF-9509131–		(22. annual National Energy and Environmental Division education and training symposium; Charlotte, NC (United States); 17-20 Sep 1995)			
1	20:21378	*See* NREL/TP–400-7830			
CONF-9509161–		(International surplus fissile materials conference; Berlin (Germany); 3-9 Sep 1995)			
1	20:20842	*See* UCRL-JC–120053			
CONF-9509162–		(Global '95; Roane/Anderson Professional Society meeting; Versailles (France); Oak Ridge, TN (United States); 11 Sep 1995; 12 apr 1995)			
1	20:21297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012297	MF-413
CONF-9509164–		(European conference on artifical life (ECAL); Barcelona (Spain); Sep 1995)			
1	20:22951	*See* LA-UR–95-1221			
CONF-950917–		(5. international conference on radioactive waste management and environmental remediation; Berlin (Germany); 3-9 Sep 1995)			
1	20:21027	*See* SAND–94-3188C			
2	20:20801	*See* LA-UR–95-256			
3	20:20800	*See* LA-UR–95-255			
4	20:20799	*See* LA-UR–95-254			
5	20:20798	*See* LA-UR–95-252			
6	20:20802	*See* LA-UR–95-331			
7	20:20852	*See* WHC-SA–2643			
8	20:21497	*See* FEMP–2347			
9	20:20775	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010222	MF-2050
10	20:21720	*See* WHC-SA–2855			
11	20:22313	*See* LBL–36825			
CONF-950919–		(ANS international conference on evaluation of emerging nuclear fuel cycle systems; Versailles (France); 11-14 Sep 1995)			
1	20:21059	*See* WSRC-MS–94-0575			
CONF-950923–		(5. international conference on facility-safeguards interface; Jackson Hole, WY (United States); 24-30 Sep 1995)			
1	20:21052	*See* LA-UR–95-323			
2	20:22096	*See* LA-UR–95-324			
CONF-950927–		(International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials; New Orleans, LA (United States); 26-29 Sep 1995)			
1	20:20980	*See* K/GDP/SAR–65			
3	20:22163	*See* BNL–61604			
CONF-950928–		(7. international topical meeting on nuclear reactor thermal-hydraulics (NURETH-7); Saratoga Springs, NY (United States); 10-15 Sep 1995)			
1	20:21262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94018040	MF-400
CONF-950936–		(Special meeting on the peaceful disposition of weapons-grade nuclear materials; Berlin (Germany); 3-9 Sep 1995)			
1	20:22328	*See* SAND–94-2418C			
CONF-950965–		(ASME fluids engineering summer meeting; Hilton Head, SC (United States); 13-18 Sep 1995)			
1	20:21819	*See* WAPD-T–3064			
CONF-950985–		(14. Institute of Electrical and Electronics Engineers (IEEE) symposium on mass storage systems; Monterey, CA (United States); 11-14 Sep 1995)			
2	20:22966	*See* UCRL-JC–120490			
CRIE-R– 93007	20:21490	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95787254	
CRIE-T– 93047	20:21454	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95787253	

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CRIE-U–					
94018	20:21491	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95787252	
CRIE-Y–					
94002	20:21338	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95787251	
DCN–					
95-209-057-05	20:21165	*See* DOE/PC/90367–T13			
DLR-FB–					
94-22	20:21795	OSTI; NTIS (US Sales Only)		DE95779814	
DMI-SR–					
94-5	20:21350	OSTI; NTIS		DE95779207	
DMI-TR–					
95-5	20:22265	OSTI; NTIS		DE95787775	
DOE–					
95012345	20:20971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012345	MF-511
DOE-STD–					
1088-95	20:22494	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014751	MF-500
DOE/AL/62350–					
151	20:20776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009832	MF-2000
177	20:20998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011234	MF-2010
183	20:20999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011231	MF-2010
190	20:21000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011233	MF-2010
192	20:21001	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011232	MF-2010
DOE/AL/82993–					
10	20:21002	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013804	MF-1290
DOE/AL/98817–					
2	20:21832	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012189	MF-900
DOE/BC–					
14958-10	20:20618	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012548	MF-122
14977-4	20:20619	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012549	MF-122
95000144	20:20625	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95000144	PC-122
DOE/BC/14471–					
19	20:20601	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000123	PC-122
DOE/BC/14652–					
15	20:20610	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000141	PC-122
DOE/BC/14852–					
12	20:20611	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012151	MF-122
DOE/BC/14882–					
10	20:21700	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000143	PC-122
DOE/BC/14883–					
11	20:20612	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012165	MF-122
DOE/BC/14886–					
11	20:20613	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012148	MF-122
DOE/BC/14893–					
5	20:20614	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000147	PC-122
DOE/BC/14897–					
5	20:20602	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000156	PC-122
DOE/BC/14951–					
10	20:20615	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000146	PC-122
DOE/BC/14954–					
10	20:20616	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012547	MF-122
DOE/BC/14955–					
8	20:20617	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012158	MF-122
DOE/BC/14983–					
4	20:20620	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012157	MF-122
DOE/BC/14984–					
3	20:20621	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012156	MF-122
DOE/BC/14986–					
3	20:20622	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000142	PC-122
4	20:20623	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012155	MF-122
DOE/BC/14991–					
3	20:20624	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012186	MF-122

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/BP/00029–					
1	20:22343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011451	MF-602
DOE/BP/27938–					
T1	20:21320	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011461	MF-1322
DOE/CE/15602–					
T2	20:21492	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014913	MF-1400
DOE/CE/15606–					
T3	20:21455	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011459	MF-1321
DOE/CE/23810–					
51C	20:21456	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011236	MF-1600
57	20:21457	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013070	MF-1600
59A	20:21458	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011237	MF-1600
DOE/CE/27504–					
T12	20:21382	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011358	MF-1320
DOE/CE/40006–					
T1	20:21493	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010952	PC-1400
DOE/CE/40905–					
57	20:21074	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010951	PC-1400
DOE/CE/41003–					
T1	20:21827	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012908	MF-1406
DOE/CE/90043–					
T2	20:21339	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013823	MF-1400
DOE/EA–					
0808	20:20972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012127	MF-630
0856	20:22363	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012235	MF-630
0934	20:21109	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012244	MF-630
0937	20:20973	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012965	MF-630
0940	20:21110	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012404	MF-630
0948	20:21003	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013800	MF-630
0976	20:20777	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012963	MF-630
0977	20:20778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012238	MF-630
0980	20:21511	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012961	MF-630
0984	20:21191	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012124	MF-630
1000	20:20974	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012248	MF-630
1005-Vol.1	20:20975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012966	MF-630
1005-Vol.2	20:20976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012967	MF-630
1009	20:20739	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012239	MF-630
1013	20:22266	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012237	MF-630
1023	20:22267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012132	MF-630
1034	20:21004	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013826	MF-630
1039	20:20779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012962	MF-630
1055	20:22268	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012960	MF-630
1063	20:20977	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013323	MF-630
1065	20:20978	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012234	MF-630
1075	20:22344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013827	MF-630
1090	20:22269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012964	MF-630
DOE/EH–					
0484	20:21351	OSTI (Free of Charge); INIS; Center for Environmental Management Information, 1-800-736-3282		TI95000207	MF-630
0488	20:21005	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013851	MF-607
DOE/EIA–					
0035(95/05)	20:21432	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012805	MF-950
0109(95/02)	20:20649	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95007674	MF-950
0109(95/05)	20:20650	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012808	MF-950
0121(94/4Q)	20:20571	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012807	MF-950
0130(95/05)	20:20706	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012801	MF-950
0202(95/2Q)	20:21414	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95011898	MF-950
0204(95/02)	20:21383	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012303	MF-950
0219(93)	20:21433	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012804	MF-950

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DOE/EIA–					
0226(95/05)	20:21425	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012802	MF-950
0340(94)/1	20:20651	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE95012803	MF-950
0340(94)2	20:20652	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE95013380	MF-950
0380(95/05)	20:20653	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95011870	MF-950
0436(94)	20:21402	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE95011851	MF-950
0466(93)	20:21377	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012008	MF-950
0520(95/05)	20:20654	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95012806	MF-950
DOE/EIS–					
0198	20:21006	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011264	MF-2010
0206	20:21144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012240	MF-630
0215-ROD	20:21352	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009934	MF-630
0215-Vol.1	20:21169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012137	MF-630
0215-Vol.2	20:21170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012138	MF-630
0218D-Summ.	20:21543	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012336	MF-2000
0218D-Vol.1	20:21544	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012337	MF-2000
0218D-Vol.2-App.A	20:21545	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012338	MF-2000
0218D-Vol.2-App.B	20:21546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012339	MF-2000
0218D-Vol.2-App.C	20:21547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012340	MF-2000
0218D-Vol.2-App.D	20:21548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012341	MF-2000
0218D-Vol.2-App.E	20:21549	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012342	MF-2000
0218D-Vol.2-App.G	20:21550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012344	MF-630
DOE/EM–					
0232-Vol.2	20:21007	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012533	MF-2070
0233	20:22270	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010337	MF-2000
0234	20:21008	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011865	MF-2000
0239	20:22904	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014141	MF-2000
DOE/EP/10050–					
T5	20:20655	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011465	MF-930
T6	20:21415	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012422	MF-900
DOE/ER–					
45372-8	20:21574	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011543	MF-404
DOE/ER/12815–					
T1-Pt.1	20:21298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009692	MF-406
T1-Pt.2	20:21299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012601	MF-406
T1-Pt.3	20:21300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012602	MF-406
DOE/ER/12900–					
T1	20:21301	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014740	MF-406
T2	20:21302	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015001	MF-406
DOE/ER/12972–					
T2	20:21263	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012415	MF-406
DOE/ER/13183–					
10	20:21701	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012902	MF-401
DOE/ER/13291–					
T1	20:20647	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011594	MF-405
DOE/ER/13460–					
1	20:21702	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014701	MF-401
3	20:21703	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014703	MF-401
6	20:21704	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014704	MF-401
DOE/ER/13770–					
T3	20:21681	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013079	MF-406
DOE/ER/13916–					
T3	20:22520	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012912	MF-411
DOE/ER/14003–					
6	20:22359	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013068	MF-408
DOE/ER/14004–					
T2	20:22378	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012449	MF-408
DOE/ER/14081–					
T4	20:20603	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012911	MF-403
T5	20:20604	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012910	MF-403

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DOE/ER/40293–					
9	20:22697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012166	MF-413
DOE/ER/40399–					
5	20:22580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012427	MF-414
DOE/ER/40561–					
176	20:22563	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012173	MF-414; MF-413
188	20:22647	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012168	MF-414; MF-413
194	20:22521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012175	MF-414; MF-413; MF-412
DOE/ER/40702–					
9	20:22698	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013071	MF-414
DOE/ER/40757–					
059	20:22564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007099	MF-414
DOE/ER/40808–					
T1	20:22699	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012197	MF-413
DOE/ER/40882–					
1	20:21384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010183	MF-400; MF-414
DOE/ER/45278–					
T2	20:22783	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011595	MF-404
DOE/ER/45361–					
3	20:21648	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012950	MF-404
DOE/ER/45378–					
T5	20:22522	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014759	MF-410
DOE/ER/45441–					
T1	20:21649	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015113	MF-404
DOE/ER/45488–					
5	20:21650	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010612	MF-404
DOE/ER/45531–					
1	20:21651	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012190	MF-411
DOE/ER/52149–					
3	20:22876	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012153	MF-406
T1	20:22877	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012147	MF-406
DOE/ER/53198–					
259	20:22845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012409	PC-426; PC-427
DOE/ER/53266–					
50	20:22927	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012142	MF-405
DOE/ER/54176–					
T1	20:22878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009925	MF-420
DOE/ER/54177–					
T2	20:21901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014302	MF-415
DOE/ER/54241–					
138	20:22846	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012144	MF-421
DOE/ER/61009–					
T1	20:22402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011919	MF-408
DOE/ER/61780–					
1	20:22364	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011299	MF-408
DOE/ER/75993–					
1	20:21340	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011581	MF-400
DOE/ET/10815–					
229	20:21443	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013083	MF-112
230	20:21444	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013082	MF-112
DOE/ET/53088–					
669	20:22501	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012133	MF-412; MF-405
703	20:22847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012134	MF-421
706	20:22523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013473	MF-420
707	20:22848	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013474	MF-420
DOE/FE–					
0330	20:21385	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012257	MF-102
0335	20:21445	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013664	MF-110
0336	20:20707	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014292	MF-131
DOE/GO–					
10095-060	20:21459	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009236	PC-920
10095-072	20:21117	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000289	PC-920
10095-076	20:21386	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017082	MF-1600

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/GO–					
10095-087	20:21460	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004009	MF-1600
10095-089	20:21075	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000241	PC-1310
10095-153	20:21387	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004060	PC-1400
10095-166	20:21076	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004081	PC-1310
10095-170	20:21494	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004086	MF-1400
10095-171	20:21481	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006858	PC-920
DOE/GO/10039–					
2	20:21068	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009193	MF-1250; MF-1360; MF-1502; MF-15
T1	20:21069	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013838	MF-1250; MF-1360; MF-1502; MF-15
DOE/HWP–					
153	20:20780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014025	MF-2070
DOE/ID–					
10478-UGF	20:21353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012050	MF-630
10489	20:21303	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010681	MF-523
DOE/ID/12911–					
1	20:21495	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013072	MF-1425
DOE/ID/13074–					
T15	20:21527	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012413	MF-1501
DOE/ID/13220–					
T4	20:21575	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012414	MF-421
DOE/ID/13230–					
T1	20:21576	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012200	MF-404
DOE/IG–					
0370	20:20656	OSTI (Free of Charge)		TI95011002	PC-960
0372	20:21426	OSTI (Free of Charge)		TI95012408	PC-960
0373	20:21388	OSTI		TI95013660	PC-960
DOE/MC–					
00098-95/C0463	20:21102	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012321	MF-131
26029-95/C0461	20:21103	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012318	MF-131
28176-95/C0468	20:20695	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012308	MF-132
29103-95/C0459	20:22271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012313	MF-2070
29252-95/C0460	20:20702	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012312	MF-131
DOE/MC/21023–					
3946	20:21154	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000039	PC-103
DOE/MC/22118–					
3942	20:20575	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000037	PC-107
3969	20:21163	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000053	PC-107
DOE/MC/25006–					
3997	20:20533	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000072	PC-103
DOE/MC/25169–					
3095	20:21446	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015701	MF-110
DOE/MC/26025–					
4058	20:20700	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014979	MF-132
DOE/MC/26042–					
4047	20:20534	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011302	MF-106; MF-103
DOE/MC/26258–					
3822	20:20726	OSTI; NTIS; GPO Dep.	E 1.99.	DE94012256	PC-123
DOE/MC/27115–					
95/C0478	20:21682	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012984	MF-100

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/MC/27286–					
3310	20:20727	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012949	MF-103; MF-123
DOE/MC/27363–					
3966	20:21155	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000051	PC-109
DOE/MC/28065–					
4014	20:21156	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000084	MF-110
DOE/MC/28162–					
4013	20:20576	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011611	MF-107; MF-113
DOE/MC/28178–					
95/C0467	20:20701	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012309	MF-131
DOE/MC/28202–					
4041	20:20535	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011303	MF-109
DOE/MC/29078–					
95/C0469	20:20605	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012999	MF-132
DOE/MC/29228–					
95/C0462	20:21104	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012319	MF-131
DOE/MC/29252–					
3954	20:20626	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000045	MF-122; MF-132
DOE/MC/29470–					
95/C0466	20:20703	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012310	MF-131
DOE/MC/30056–					
4046	20:20536	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009702	MF-109
DOE/MC/30070–					
95/C0470	20:20704	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012307	MF-132
DOE/MC/30084–					
3864	20:21418	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000078	MF-131
DOE/MC/30085–					
95/C0458	20:20696	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011340	MF-132
DOE/MC/30139–					
3971	20:20698	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000055	PC-132
95/C0457	20:20697	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011339	MF-132
DOE/MC/30246–					
4022	20:21157	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000092	MF-111
DOE/MC/30251–					
4034	20:20577	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000097	MF-105
DOE/MC/30252–					
4024	20:20578	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000094	MF-105
DOE/MC/30362–					
4049	20:21731	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000095	MF-2060
DOE/MC/31113–					
95/C0471	20:20723	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012306	MF-132
DOE/MC/31182–					
95/C0479	20:20699	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012263	MF-132
DOE/MC/32073–					
95/C0464	20:20705	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012320	MF-131
DOE/MD–					
0001	20:21048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011045	MF-940
DOE/METC–					
95/1013	20:20537	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020 (United States); GPO Dep.	E 1.99:	DE95012201	MF-113
DOE/MT/94003–					
3	20:20658	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012187	MF-122
DOE/MT/95004–					
1	20:22971	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012183	MF-122
DOE/MT/95006–					
1	20:20659	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012443	MF-121
DOE/NV–					
367	20:21304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012785	MF-707
DOE/NV/11432–					
171	20:21354	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011300	MF-701
177	20:22471	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011828	MF-600
T6	20:21073	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013095	MF-706; MF-708
DOE/OR–					
01-1326-D1/V1	20:21009	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012491	MF-402

DOE/OR–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
01-1326-D1/V2	20:21010	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012490	MF-2010
01-1326-D1/V3	20:21011	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012492	MF-2010
01-1326-D1/V4	20:21012	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012540	MF-2070
DOE/OR/21921–					
T2	20:20781	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011452	MF-721
DOE/OR/21999–					
T1	20:21321	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012196	MF-700
DOE/OR/22088–					
T1	20:21139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013081	MF-1240
T2	20:21140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013080	MF-1240
DOE/OR/22160–					
T17	20:21013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007851	MF-2000
DOE/OSTI–					
3406(Suppl.4)(Add.2)	20:20782	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95005302	PC-814
DOE/PC/79796–					
T38-Vol.2	20:20586	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009448	PC-105
T42	20:20587	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012445	MF-105
DOE/PC/79818–					
T13	20:20538	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009312	PC-108
DOE/PC/88697–					
T10	20:20588	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011388	MF-104
DOE/PC/88802–					
T10	20:20540	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011909	MF-108
T9	20:20539	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011908	MF-108
DOE/PC/88881–					
T26-Vol.2	20:20526	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011486	PC-102
T27	20:20527	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014326	MF-102
DOE/PC/89881–					
T15	20:20541	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014320	MF-113
DOE/PC/89908–					
T32	20:20528	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010650	PC-102
DOE/PC/90027–					
T12	20:20542	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011379	MF-108
DOE/PC/90045–					
T10	20:20543	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012296	MF-109
T11	20:20544	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012903	MF-109
T12	20:20545	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012904	MF-109
T13	20:20546	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012905	MF-109
T14	20:20547	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012906	MF-109
DOE/PC/90054–					
T10	20:20552	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014746	MF-113
T11	20:20553	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014747	MF-113
T12	20:20554	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014748	MF-113
T6	20:20548	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014742	MF-113
T7	20:20549	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014743	MF-113
T8	20:20550	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014744	MF-113
T9	20:20551	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014745	MF-113
DOE/PC/90155–					
T13	20:20589	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011476	MF-104
DOE/PC/90184–					
T18	20:20581	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015601	MF-117
DOE/PC/90287–					
T18	20:20572	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014324	MF-102
DOE/PC/90293–					
T15	20:20555	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009310	PC-113
DOE/PC/90365–					
T13	20:21164	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011920	MF-104
DOE/PC/90367–					
T13	20:21165	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011466	PC-105
DOE/PC/91030–					
T13	20:21705	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014334	MF-131
T14	20:21706	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014333	MF-131
DOE/PC/91051–					
T8-Vol.1	20:20556	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009446	PC-108
T9	20:20557	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011907	MF-108

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/91055–					
T11	20:20558	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014329	MF-108
DOE/PC/91160–					
T5	20:20590	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011927	MF-104
DOE/PC/91311–					
T14	20:20559	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015613	MF-108
DOE/PC/92112–					
T9	20:21105	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014323	MF-108
DOE/PC/92113–					
T7	20:21106	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012418	MF-113
DOE/PC/92149–					
T9	20:20560	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015612	MF-108
DOE/PC/92159–					
T10	20:20591	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010652	MF-113
T11	20:20592	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012419	MF-113
DOE/PC/92162–					
T5	20:20529	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012424	MF-104; MF-102
DOE/PC/92528–					
9	20:20593	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012428	MF-103
DOE/PC/92578–					
T7	20:20582	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012450	MF-117
DOE/PC/93051–					
T4	20:20573	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010623	MF-113
DOE/PC/93218–					
6	20:20561	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012429	MF-102
DOE/PC/93226–					
T6	20:20594	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014339	MF-104
DOE/PC/93254–					
T1	20:21166	OSTI; NTIS; GPO Dep.	E 1.99:	DE95005662	PC-105
DOE/PC/94155–					
T1	20:20530	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010656	MF-102
DOE/PC/94206–					
T2	20:20562	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015614	MF-102; MF-108
DOE/PC/94209–					
T2	20:20563	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012252	MF-102
DOE/PC/94219–					
T2	20:20564	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015610	MF-108
DOE/PO–					
0033	20:21427	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011786	MF-900
DOE/RL–					
364162-1-Vol.4	20:20784	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010981	MF-2000
94-107-Rev.1	20:21014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007975	MF-2050
94-36-4	20:22272	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012821	MF-2070
95-15	20:20783	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011574	MF-2020
DOE/S–					
0112	20:21403	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013665	PC-900
DOE/SR/15160–					
6-Vol.1	20:22273	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012406	MF-703
7-Vol.2	20:22274	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012405	MF-703
DOE/SR/15191–					
T1	20:22275	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012444	MF-708
DOE/WIPP–					
95-1090	20:20785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012516	MF-810
95-2092	20:20786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012971	MF-815
DPW–					
56-7-4	20:21264	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012030	MF-520
56-7-6	20:20730	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012029	MF-520
56-7-7	20:20731	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012031	MF-520
DTU-LV–					
95-7	20:21127	OSTI; NTIS		DE95779208	
95-08	20:21327	OSTI; NTIS		DE95779209	
95-13	20:20724	OSTI; NTIS		DE95787735	
DTU-LV-MEDD–					
275	20:21124	OSTI; NTIS		DE95787736	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DUN–					
2011	20:21267	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013942	MF-500
2347	20:21268	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012651	MF-500
2424	20:21269	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013920	MF-500
2903-RD	20:21015	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012654	MF-507
4452	20:21270	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013915	MF-500
4562	20:21271	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012655	MF-500
4699	20:21272	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012635	MF-520
4812	20:21273	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013919	MF-500
5200-RD	20:20787	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012639	MF-510
525-3	20:21265	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012762	MF-500
5253	20:21274	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012609	MF-500
5430	20:21275	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012697	MF-520
5611	20:21276	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013914	MF-500
5612	20:21277	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013913	MF-500
6270	20:21278	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013923	MF-500
6271	20:21279	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013922	MF-500
6272	20:21280	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013921	MF-500
6485	20:21281	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012637	MF-504
7740	20:21282	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014067	MF-500
7741	20:21283	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014066	MF-500
777	20:21266	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012653	MF-500
DUN-AOP–					
213	20:21284	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012711	MF-500
EDF–					
94-NB-00091	20:21184	OSTI; NTIS (US Sales Only); INIS		DE95631405	
94-NB-00095	20:21185	OSTI; NTIS (US Sales Only); INIS		DE95631407	
EEV–					
95-01	20:21146	OSTI; NTIS		DE95787742	
EGG-SE–					
5683	20:21577	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011406	MF-504; MF-506
EPRI–					
95011538	20:21172	OSTI; EPRI Distribution Center, 207 Coggins Drive, PO Box 23205, Pleasant Hill, CA 94523 (United States); INIS		TI95011538	
ES/CNPE–					
2	20:22502	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011542	MF-403; MF-406
ES/ER/TM–					
137	20:22972	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013299	MF-2000
145	20:22170	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014026	MF-2000
152	20:22276	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012979	MF-2070
ES/ESH–					
48	20:20979	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013227	MF-2070
ESTSC–					
000734MLTPL01	20:22928	ESTSC			
000788MLTPL00	20:22929	ESTSC			
000814X309000	20:22930	ESTSC			
000815SPARC00	20:22931	ESTSC			
000823MLTPL00	20:22932	ESTSC			
000830MLTPL00	20:22933	ESTSC			
000835MLTPL00	20:22934	ESTSC			
000847MLTPL00	20:22935	ESTSC			
001021U110000	20:22936	ESTSC			
001023SPARC00	20:22937	ESTSC			
001025SUN0000	20:22938	ESTSC			
001026SGIIP00	20:22939	ESTSC			
001027SUN0000	20:22940	ESTSC			
001030IB48600	20:22941	ESTSC			
001031SUN0000	20:22942	ESTSC			
001043CY00100	20:22943	ESTSC			
001044C760000	20:22944	ESTSC			
001044CY00100	20:22945	ESTSC			
001047C007400	20:22946	ESTSC			
001055D664000	20:22947	ESTSC			
001056IBMPC00	20:22948	ESTSC			

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001057D642000	20:22949	ESTSC			
ETDE-DE–					
110	20:21434	OSTI; NTIS (US Sales Only)		DE95778070	
111	20:20599	OSTI; NTIS (US Sales Only)		DE95777859	
112	20:22171	OSTI; NTIS (US Sales Only)		DE95778048	
113	20:20694	OSTI; NTIS (US Sales Only)		DE95779820	
114	20:21461	OSTI; NTIS (US Sales Only)		DE95780069	
115	20:22472	OSTI; NTIS (US Sales Only)		DE95785950	
116	20:21355	OSTI; NTIS (US Sales Only)		DE95780042	
117	20:22473	OSTI; NTIS (US Sales Only)		DE95785648	
118	20:22474	OSTI; NTIS (US Sales Only)		DE95785630	
119	20:22475	OSTI; NTIS (US Sales Only)		DE95785628	
120	20:22345	OSTI; NTIS (US Sales Only)		DE95785544	
121	20:22476	OSTI; NTIS (US Sales Only)		DE95785667	
122	20:22477	OSTI; NTIS (US Sales Only)		DE95785649	
123	20:21707	OSTI; NTIS (US Sales Only)		DE95780302	
124	20:21077	OSTI; NTIS (US Sales Only)		DE95780303	
125	20:21796	OSTI; NTIS (US Sales Only)		DE95780379	
126	20:21336	OSTI; NTIS (US Sales Only)		DE95780191	
127	20:21421	OSTI; NTIS (US Sales Only)		DE95786068	
128	20:20627	OSTI; NTIS (US Sales Only)		DE95780311	
129	20:22478	OSTI; NTIS (US Sales Only)		DE95780182	
130	20:22479	OSTI; NTIS (US Sales Only)		DE95780160	
131	20:21158	OSTI; NTIS (US Sales Only)		DE95785864	
132	20:21159	OSTI; NTIS (US Sales Only)		DE95785863	
133	20:21428	OSTI; NTIS (US Sales Only)		DE95785450	
134	20:21797	OSTI; NTIS (US Sales Only)		DE95786089	
135	20:21828	OSTI; NTIS (US Sales Only)		DE95786082	
136	20:21798	OSTI; NTIS (US Sales Only)		DE95786090	
142	20:21078	OSTI; NTIS (US Sales Only)		DE95786064	
144	20:21496	OSTI; NTIS (US Sales Only)		DE95785918	
148	20:21462	OSTI; NTIS (US Sales Only)		DE95785917	
149	20:22151	OSTI; NTIS (US Sales Only)		DE95785473	
79	20:21447	OSTI; NTIS (US Sales Only)		DE95780180	
ETDE/JP-mf–					
95786711	20:20606	OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan		DE95786711	
95786715	20:20607	OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan		DE95786715	
95786721	20:20608	OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan		DE95786721	
95786726	20:20628	OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan		DE95786726	
95786730	20:20629	OSTI; NTIS; Available from Japan National Oil Corporation, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan		DE95786730	
95786807	20:21136	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786807	
95786813	20:21141	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786813	
95786815	20:21137	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786815	
95786816	20:21138	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786816	
95787235	20:20580	OSTI; NTIS; Available from Coal Mining Research Center, Japan, 2-10, Kanda Jinbocho, Chiyoda-ku, Tokyo, Japan		DE95787235	
95787249	20:21619	OSTI; NTIS; Available from National Institute for Research in Inorganic Materials, 1-1, Namiki, Tsukuba, Ibaraki, Japan		DE95787249	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
95787263	20:21337	OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo, Japan		DE95787263	
EUR-CEA-FC–					
1507	20:22849	OSTI; NTIS (US Sales Only); INIS		TI95631982	
FEI–					
2353	20:22843	OSTI; NTIS (US Sales Only); INIS		DE95634592	
2355	20:21220	OSTI; NTIS (US Sales Only); INIS		DE95633538	
2357	20:22682	OSTI; NTIS (US Sales Only); INIS		DE95634090	
2358	20:21620	OSTI; NTIS (US Sales Only); INIS		DE95633129	
2372	20:21578	OSTI; NTIS (US Sales Only); INIS		DE95633059	
2373	20:21652	OSTI; NTIS (US Sales Only); INIS		DE95633166	
2378	20:21799	OSTI; NTIS (US Sales Only); INIS		DE95633491	
2379	20:21860	OSTI; NTIS (US Sales Only); INIS		DE95633504	
2381	20:22700	OSTI; NTIS (US Sales Only); INIS		DE95634124	
2383	20:21195	OSTI; NTIS (US Sales Only); INIS		DE95633613	
2389	20:21861	OSTI; NTIS (US Sales Only); INIS		DE95633505	
2390	20:22701	OSTI; NTIS (US Sales Only); INIS		DE95634109	
2392	20:22073	OSTI; NTIS (US Sales Only); INIS		DE95633646	
2393	20:21717	OSTI; NTIS (US Sales Only); INIS		DE95633015	
2394	20:21718	OSTI; NTIS (US Sales Only); INIS		DE95633016	
2395	20:21719	OSTI; NTIS (US Sales Only); INIS		DE95633017	
2397	20:22074	OSTI; NTIS (US Sales Only); INIS		DE95633647	
2402	20:22702	OSTI; NTIS (US Sales Only); INIS		DE95634125	
2413	20:21579	OSTI; NTIS (US Sales Only); INIS		DE95633088	
2415	20:21580	OSTI; NTIS (US Sales Only); INIS		DE95633060	
FEMP–					
2347	20:21497	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007826	MF-702; MF-704
2425	20:22905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013795	MF-2000
FN–					
447	20:22003	*See* SSC–106			
FNAL/C–					
95-060-E	20:22581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011499	MF-414
95/049	20:22648	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013245	MF-414
95/056	20:22950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010572	MF-414
95/062-E	20:22582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011500	MF-414
95/065	20:22524	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013239	MF-412
95/076-E	20:21965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011837	MF-414
95/086	20:22075	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013001	MF-414
95/087	20:21966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011836	MF-414
95/094	20:22565	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013003	MF-414
95/095-E	20:22583	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013246	MF-414
95/097	20:21902	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013005	MF-414
95/098	20:21903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013004	MF-414
95/100	20:22056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013238	MF-414
95/102-E	20:22584	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013000	MF-414
95/104	20:21904	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013244	MF-414
95/105	20:21967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013236	MF-414
95/106-E	20:22585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013584	MF-414
95/110	20:22076	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012968	MF-414
95/122	20:21905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012972	MF-414
95/123	20:21862	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013243	MF-414
95/124	20:21968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013247	MF-414
95/133-E	20:22586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013585	MF-414
95/137-E	20:22587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013588	MF-414
95/145	20:21969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013586	MF-406; MF-414
95116-E	20:22588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012973	MF-414
FRCR–					
454	20:22927	*See* DOE/ER/53266–50			
456	20:22846	*See* DOE/ER/54241–138			
FURNAS-DEN-N–					
021/91	20:21187	OSTI; NTIS (US Sales Only); INIS		DE95632442	
029/91(Rev.1)	20:21188	OSTI; NTIS (US Sales Only); INIS		DE95632443	
FZKA–					
5514	20:21683	OSTI; NTIS (US Sales Only)		DE95779674	
FZR–					
77	20:22795	OSTI; NTIS (US Sales Only); INIS		DE95785380	

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GA–					
A21994	20:22869	*See* UCRL-JC–119283			
GRS–					
110	20:21305	OSTI; NTIS (US Sales Only); INIS		DE95780099	
GRS-F–					
1/1994	20:21309	OSTI; NTIS (US Sales Only); INIS		DE95785362	
GSF–					
01/95	20:21079	OSTI; NTIS (US Sales Only)		DE95779579	
26/94	20:22277	OSTI; NTIS (US Sales Only)		DE95779666	
HMI-B–					
523	20:21653	OSTI; NTIS (US Sales Only); INIS		DE95785376	
HUTP–					
90/A029	20:22577	*See* SSCL-Preprint–13			
HW–					
8140	20:21732	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013953	MF-500
8285	20:21733	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013954	MF-500
8323	20:21734	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013956	MF-500
8347	20:20732	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013955	MF-500
Hep-ph–					
9505273.	20:22589	*See* IC–95/50			
9505275.	20:22567	*See* IC–95/76			
9505335.	20:22566	*See* IC–95/45			
IAEA-R–					
5146-F	20:22379	OSTI; NTIS (US Sales Only); INIS		DE95631108	
IAEA-TECDOC–					
795	20:21240	OSTI; NTIS (US Sales Only); INIS		DE95633388	
797	20:21174	OSTI; NTIS (US Sales Only); INIS		DE95633550	
798	20:21196	OSTI; NTIS (US Sales Only); INIS		DE95633614	
IC–					
95/21	20:22525	OSTI; NTIS (US Sales Only); INIS		DE95633918	
95/26	20:22526	OSTI; NTIS (US Sales Only); INIS		DE95633919	
95/45	20:22566	OSTI; NTIS (US Sales Only); INIS		DE95633969	
95/50	20:22589	OSTI; NTIS (US Sales Only); INIS		DE95633989	
95/51	20:22305	OSTI; NTIS (US Sales Only); INIS		DE95633181	
95/53	20:22800	OSTI; NTIS (US Sales Only); INIS		DE95634579	
95/63	20:22541	OSTI; NTIS (US Sales Only); INIS		DE95631723	
95/65	20:22792	OSTI; NTIS (US Sales Only); INIS		DE95634553	
95/67	20:22380	OSTI; NTIS (US Sales Only); INIS		DE95633291	
95/68	20:22542	OSTI; NTIS (US Sales Only); INIS		DE95633928	
95/70	20:22507	OSTI; NTIS (US Sales Only); INIS		DE95633900	
95/71	20:22508	OSTI; NTIS (US Sales Only); INIS		DE95633901	
95/72	20:22509	OSTI; NTIS (US Sales Only); INIS		DE95633902	
95/73	20:22784	OSTI; NTIS (US Sales Only); INIS		DE95634466	
95/75	20:22801	OSTI; NTIS (US Sales Only); INIS		DE95634580	
95/76	20:22567	OSTI; NTIS (US Sales Only); INIS		DE95633955	
95/77	20:22381	OSTI; NTIS (US Sales Only); INIS		DE95633292	
95/78	20:22777	OSTI; NTIS (US Sales Only); INIS		DE95634209	
95/79	20:22527	OSTI; NTIS (US Sales Only); INIS		DE95633920	
95/80	20:22568	OSTI; NTIS (US Sales Only); INIS		DE95633970	
95/81	20:22510	OSTI; NTIS (US Sales Only); INIS		DE95633903	
95/82	20:22195	OSTI; NTIS (US Sales Only); INIS		DE95633238	
95/92	20:22802	OSTI; NTIS (US Sales Only); INIS		DE95634581	
IEE-SR–					
261	20:21419	OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo, Japan		DE95786742	
IFSR–					
669	20:22501	*See* DOE/ET/53088–669			
703	20:22847	*See* DOE/ET/53088–703			
706	20:22523	*See* DOE/ET/53088–706			
707	20:22848	*See* DOE/ET/53088–707			
ILAS/FM–					
9/1994.	20:22541	*See* IC–95/63			
ILK-B–					
3/93/1314	20:21463	OSTI; NTIS (US Sales Only)		DE95786070	
INCT–					
2157/7	20:21065	OSTI; NTIS; INIS		DE95632412	
INEL–					
95/0073-Vol.1	20:20808	*See* NUREG/CR–6256-Vol.1			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
INIS-BR–					
3506	20:22407	OSTI; NTIS (US Sales Only); INIS		DE95631124	
3523	20:20579	OSTI; NTIS (US Sales Only); INIS		DE95633430	
3526	20:21325	OSTI; NTIS (US Sales Only); INIS		DE95633449	
3538	20:21111	OSTI; NTIS (US Sales Only); INIS		DE95632376	
INIS-GB–					
660	20:21227	OSTI; NTIS (US Sales Only); INIS		DE95632434	
INIS-PE–					
95-02	20:22350	OSTI; NTIS (US Sales Only); INIS		DE95632317	
INIS-RU–					
405	20:22590	OSTI; NTIS (US Sales Only); INIS		DE95632424	
406	20:22395	OSTI; NTIS (US Sales Only); INIS		DE95632291	
INIS-mf–					
14535	20:21060	OSTI; NTIS (US Sales Only); INIS		DE95631065	
14540	20:20708	OSTI; NTIS (US Sales Only); INIS		DE95631159	
14543	20:22349	OSTI; NTIS (US Sales Only); INIS		DE95631062	
14548	20:22408	OSTI; NTIS (US Sales Only); INIS		DE95633405	
14549	20:20716	OSTI; NTIS (US Sales Only); INIS		DE95633438	
15112	20:20788	OSTI; NTIS (US Sales Only); INIS		DE95785652	
15113	20:21621	OSTI; NTIS (US Sales Only); INIS		DE95785525	
15114	20:21360	OSTI; NTIS (US Sales Only); INIS		DE95785377	
INP–					
1615/D	20:22309	OSTI; NTIS; INIS		DE95632292	
1648/CA	20:21692	OSTI; NTIS; INIS		DE95632164	
INPO–					
95011853	20:21389	OSTI; INIS; NTIS; Institute of Nuclear Power Operations, 700 Galleria Parkway, Atlanta, GA 30339-5957 (United States)		DE95011853	
95012838	20:21390	OSTI; INIS; NTIS; Institute of Nuclear Power Operations, 700 Galleria Parkway, Atlanta, GA 30339-5957 (United States)		DE95012838	
INS–					
1080	20:22778	OSTI; NTIS; INIS		DE95780501	
1082	20:22713	OSTI; NTIS; INIS		DE95780480	
1083	20:22714	OSTI; NTIS; INIS		DE95780481	
1090	20:22666	OSTI; NTIS; INIS		DE95780482	
IS-T–					
1697	20:22785	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010129	MF-404
1714	20:21582	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010130	MF-404
1732	20:22786	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010128	MF-404
ITER/US–					
95/IV-BL-05	20:22874	*See* ANL/FPP/TM–281			
JAERI-Research–					
95-005	20:21285	OSTI; NTIS; INIS		DE95780484	
95-007	20:21206	OSTI; NTIS; INIS		DE95780485	
95-013	20:21179	OSTI; NTIS; INIS		DE95780630	
95-015	20:21208	OSTI; NTIS; INIS		DE95780587	
95-016	20:22196	OSTI; NTIS; INIS		DE95780589	
95-020	20:20728	OSTI; NTIS; INIS		DE95780613	
95-022	20:21286	OSTI; NTIS; INIS		DE95780612	
95-024	20:22310	OSTI; NTIS; INIS		DE95780611	
95-026	20:21287	OSTI; NTIS; INIS		DE95780614	
JAERI-Review–					
95-001	20:21735	OSTI; NTIS; INIS		DE95780588	
JAERI-Tech–					
94-037	20:22879	OSTI; NTIS; INIS		DE95780675	
95-001	20:21288	OSTI; NTIS; INIS		DE95780586	
95-004	20:22715	OSTI; NTIS; INIS		DE95780483	
95-012	20:21228	OSTI; NTIS; INIS		DE95780604	
95-025	20:21736	OSTI; NTIS; INIS		DE95780610	
JFP–					
18	20:21583	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012632	MF-504
JINR-D–					
13-94-478	20:22093	OSTI; NTIS (US Sales Only); INIS		DE95632458	
JINR-E–					
13-94-502	20:22095	OSTI; NTIS (US Sales Only); INIS		DE95631509	
2-94-438	20:22619	OSTI; NTIS (US Sales Only); INIS		DE95632544	
2-94-488	20:22570	OSTI; NTIS (US Sales Only); INIS		DE95632521	
K/GDP/SAR–					
65	20:20980	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007708	MF-902

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K/TCD–					
1127	20:22456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012978	MF-2050
KAPL–					
4790	20:21709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012294	PC-501
KB–					
24/1264/91	20:21797	*See* ETDE-DE–134			
24/1265/91	20:21798	*See* ETDE-DE–136			
KCP–					
613-5537	20:21833	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011239	MF-706
613-5632	20:21498	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013484	MF-706
KTH-IT-M–					
36	20:21128	OSTI; NTIS		DE95779292	
LA–					
12573-MS	20:20981	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011012	MF-814
12671-MS	20:21808	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011855	MF-910; MF-906
12779-MS	20:20789	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010558	MF-802
12886-MS	20:20790	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012118	MF-814; MF-802
12907	20:20791	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010559	MF-721
12925-MS	20:21754	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012119	MF-714
12928-MS	20:20792	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010556	MF-907
12929-MS	20:21049	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012976	MF-700
12932-MS	20:22197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009617	MF-902
12936-MS	20:20793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012116	MF-721
12938	20:20736	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012117	MF-706
12939-MS	20:22124	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012141	MF-741
12941-T	20:21050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010680	MF-700
12942-MS	20:21554	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012989	MF-703
12943	20:20794	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013479	PC-2030
12944-MS	20:21063	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010553	MF-708
12949-MS	20:20795	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012988	MF-721
12952-MS	20:22457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010555	MF-707
12964-MS	20:21051	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012975	MF-700
LA-SUB–					
94-15	20:21834	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010871	MF-700
94-168	20:21809	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011637	MF-705
94-37	20:21693	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011062	MF-706; MF-704
94-63	20:22068	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011063	MF-706
94-72	20:21289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011064	MF-940
95-3	20:22761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011620	MF-910
95-14	20:22147	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011621	MF-700
95-21	20:21254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007620	MF-700
95-27-1	20:22311	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007639	MF-2000
95-36-Vol.3	20:20796	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013478	MF-814
95-41	20:20797	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012085	MF-814
95-43	20:21215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008967	MF-401
95-45	20:21237	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011854	
95-55	20:22529	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012953	MF-903
95-56	20:22503	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012954	MF-903
95-58	20:22530	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012955	MF-903
95-63	20:21622	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012078	MF-906
LA-UR–					
95-1077	20:22198	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009496	MF-702
95-1145	20:21810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009481	MF-910
95-1164	20:22126	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010888	
95-1168	20:21654	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010928	MF-704
95-1210	20:21976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010934	MF-406; MF-414
95-1221	20:22951	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012995	
95-1270	20:20803	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012075	MF-902
95-1282	20:21053	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010852	MF-900
95-1305	20:22458	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014016	MF-940; MF-907
95-1306	20:22880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012073	MF-712
95-1319	20:21585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012072	MF-704
95-1320	20:21586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012071	MF-404; MF-411

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95-1325	20:22366	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012069	MF-708
95-1333	20:22851	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012068	MF-712
95-1336	20:21756	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012067	
95-1341	20:22762	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012066	MF-700
95-1350	20:22881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012065	MF-712
95-1353	20:22199	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012062	MF-402
95-1359	20:21450	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012060	MF-1502
95-1370	20:21070	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012059	MF-401
95-1375	20:22554	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012056	MF-414
95-1393	20:21054	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012053	MF-900
95-1411	20:22952	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012052	MF-905
95-1417	20:21555	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012000	MF-700
95-1450	20:21977	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011999	MF-706
95-1478	20:22367	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011995	MF-908
95-1486	20:21066	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011994	MF-704; MF-706
95-1501	20:21978	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011991	MF-414
95-1502	20:21835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011990	MF-706
95-1506	20:21979	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011989	MF-706
95-1507	20:21864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011988	MF-706
95-1508	20:21865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011987	MF-706
95-1509	20:20804	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011986	MF-706
95-1540	20:22516	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011981	
95-1543	20:21655	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011980	MF-705
95-1547	20:21908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011979	MF-414
95-1548	20:21980	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011978	MF-414
95-1553	20:21981	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011976	MF-414
95-1555	20:21656	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011975	MF-904
95-1564	20:22097	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011974	MF-706
95-1566	20:21866	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011973	MF-414
95-1935	20:21207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014019	MF-700
95-252	20:20798	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006270	MF-2000
95-254	20:20799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006269	MF-2020
95-255	20:20800	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006267	MF-2020
95-256	20:20801	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006268	MF-2020
95-323	20:21052	OSTI; NTIS; GPO Dep.	E 1.99:	DE95006279	MF-900
95-324	20:22096	OSTI; NTIS; GPO Dep.	E 1.99:	DE95006278	MF-900
95-331	20:20802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006277	MF-721
95-610	20:22125	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007854	
95-692	20:21755	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007853	MF-2000
95-739	20:21584	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007852	MF-704
95-887	20:22504	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009428	MF-703
95-926	20:21255	OSTI; NTIS; INIS		TI95009422	
LAMP–					
95/3	20:22514	OSTI; NTIS (US Sales Only); INIS		DE95633904	
LBL–					
32420	20:21464	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011269	MF-1600
34499	20:21657	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011266	MF-404; MF-411
34503	20:22118	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011280	MF-410
35419	20:21982	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012379	MF-406
35423	20:21983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012387	MF-422
35424	20:21625	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012391	MF-404
35425	20:21984	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012383	MF-414
35809	20:21332	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012756	MF-1501
35963	20:22799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011278	MF-406
36055-Rev.	20:21985	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012356	MF-405
36119	20:21465	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012334	MF-1600
36132	20:22517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012324	MF-414
36243	20:21466	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012250	MF-1600
36306	20:21986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012384	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
36332	20:22356	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012358	MF-408
36350	20:21987	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012355	MF-406
36386	20:20805	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012357	MF-810
36615	20:22776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011276	MF-414
36616	20:22368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012354	MF-406; MF-408
36630-Rev.	20:22377	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012388	MF-607
36640	20:21710	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012385	MF-401
36651	20:22763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011263	MF-413
36680	20:22953	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012325	MF-405
36696	20:21658	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011268	MF-410
36711	20:22098	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012323	MF-414
36749	20:21757	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012386	MF-406
36807	20:22312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012438	MF-814
36813	20:21451	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011273	
36819	20:22555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012353	MF-414
36825	20:22313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012351	MF-2070
36831	20:22314	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012376	MF-400
36839	20:21988	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012389	MF-414
36841	20:21867	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012440	MF-414
36842	20:21909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012439	MF-414
36843	20:21910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012441	MF-414
36844	20:21989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012442	MF-414
36845	20:22112	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011272	MF-410
36849	20:21142	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012390	MF-1240; MF-1245
36872	20:20806	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012392	MF-814
36873	20:21133	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012382	MF-1240
36883	20:22764	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012326	MF-414
36896	20:21467	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011282	MF-1600
36900	20:21659	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012363	MF-122
36903	20:21660	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012757	MF-400
36908	20:22099	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012366	MF-413; MF-414
36909	20:21661	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012322	MF-404
36911	20:21662	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012352	MF-404
36919	20:22771	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012329	MF-411
36921	20:22360	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011259	MF-408
36923	20:22772	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012360	MF-411
36924	20:21626	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012381	MF-404
36933	20:21468	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012758	MF-1600
36944	20:21811	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012328	MF-1240
36950	20:21990	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012333	MF-410; MF-406
36962	20:22556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012377	MF-414
36971	20:21663	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012362	MF-400
37004	20:22315	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012361	MF-400
37014	20:22630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012380	MF-414
37016	20:22557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012331	MF-414
37020	20:22765	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012327	MF-414
37024	20:21469	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012374	MF-1600
37027	20:20565	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012759	MF-109
37028	20:20566	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012760	MF-109
37050	20:21911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012761	MF-414
37066	20:21812	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012332	MF-814
37071	20:21333	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012369	MF-1500
37086	20:21664	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012359	MF-404
37096	20:22100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012375	MF-414; MF-604; MF-606
37216	20:21844	*See* SLAC-PUB–95-6885			
37227	20:22104	*See* SLAC-PUB–95-6890			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
37345	20:21998	*See* SLAC-PUB–95-6848			
LBL-PUB–					
3125-Vol.2	20:21391	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012367	MF-400; MF-500; MF-700; MF-900
3274-Rev.(1995)	20:21341	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012378	MF-400
5396	20:21392	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011292	MF-400
758(Rev.3/95)	20:21470	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012304	MF-1600
LLNL–					
95012992	20:20807	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012992	MF-814
LUTFD2-TFCP–					
1003	20:21721	OSTI; NTIS		DE95779293	
LUTMDN-TMVK–					
3171	20:21813	OSTI; NTIS		DE95779299	
5247	20:21512	OSTI; NTIS		DE95779301	
5248	20:21499	OSTI; NTIS; INIS		DE95779302	
5249	20:21830	OSTI; NTIS		DE95779294	
5250	20:21513	OSTI; NTIS		DE95779300	
7018	20:21814	OSTI; NTIS		DE95779303	
7019	20:21815	OSTI; NTIS		DE95779304	
7021	20:20725	OSTI; NTIS		DE95779305	
MAE–					
303	20:21711	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015964	MF-113
304	20:20583	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015963	MF-117
MISU-IMI-CM–					
84	20:22200	OSTI; NTIS		DE95779295	
MZ-TH–					
95-15	20:22566	*See* IC–95/45			
NDP–					
048	20:22505	*See* ORNL/CDIAC–66			
049	20:22239	*See* ORNL/CDIAC–80			
050	20:22322	*See* ORNL/CDIAC–79			
NEDO-C–					
9213	20:20567	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786803	
9330	20:20568	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786811	
9331	20:20597	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786812	
NEDO-GET–					
9310-2	20:21361	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786802	
NEDO-IT–					
9209	20:21712	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786809	
9210	20:22369	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786810	
9320	20:21713	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786808	
NEDO-P–					
9311	20:21071	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786805	

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9317	20:21118	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786814	
9322	20:21393	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786804	
9325	20:21134	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95786806	
NEI-DK–					
1983	20:21437	OSTI; NTIS		DE95779153	
1984	20:21471	OSTI; NTIS		DE95779157	
1985	20:21472	OSTI; NTIS		DE95779158	
1986	20:21473	OSTI; NTIS		DE95779159	
1988	20:21167	OSTI; NTIS		DE95779161	
1990	20:22316	OSTI; NTIS		DE95779154	
1995	20:21500	OSTI; NTIS		DE95779151	
1997	20:21083	OSTI; NTIS		DE95779165	
1998	20:21474	OSTI; NTIS		DE95779160	
2000	20:21084	OSTI; NTIS		DE95779200	
2004	20:21394	OSTI; NTIS		DE95779205	
2007	20:21501	OSTI; NTIS		DE95779201	
2009	20:21342	OSTI; NTIS		DE95779216	
2010	20:21081	OSTI; NTIS		DE95779221	
2011	20:21082	OSTI; NTIS		DE95779220	
2012	20:22201	OSTI; NTIS		DE95779224	
2013	20:21665	OSTI; NTIS		DE95779223	
2015	20:21091	OSTI; NTIS; INIS		DE95779210	
2016	20:21085	OSTI; NTIS		DE95779212	
2017	20:21417	OSTI; NTIS		DE95779222	
2018	20:21435	OSTI; NTIS		DE95779217	
2020	20:22317	OSTI; NTIS		DE95787782	
2021	20:22202	OSTI; NTIS		DE95787783	
2022	20:21125	OSTI; NTIS		DE95787773	
2024	20:21438	OSTI; NTIS		DE95787787	
2025	20:21439	OSTI; NTIS		DE95787790	
2026	20:22203	OSTI; NTIS		DE95787784	
2027	20:22204	OSTI; NTIS		DE95787805	
2028	20:22208	OSTI; NTIS		DE95787786	
2032	20:21092	OSTI; NTIS; INIS		DE95787770	
2033	20:21093	OSTI; NTIS; INIS		DE95787771	
2034	20:21094	OSTI; NTIS; INIS		DE95787767	
2035	20:21502	OSTI; NTIS		DE95787768	
2037	20:21160	OSTI; NTIS		DE95787799	
2042	20:21503	OSTI; NTIS		DE95787800	
2043	20:22491	OSTI; NTIS		DE95787792	
2045	20:21440	OSTI; NTIS		DE95787759	
2046	20:21395	OSTI; NTIS		DE95787758	
2047	20:21420	OSTI; NTIS		DE95787753	
2048	20:21485	OSTI; NTIS		DE95787752	
2049	20:21514	OSTI; NTIS		DE95787756	
2050	20:21486	OSTI; NTIS		DE95787757	
2060	20:21441	OSTI; NTIS		DE95787843	
2061	20:21442	OSTI; NTIS		DE95787844	
2062	20:21147	OSTI; NTIS		DE95787838	
2063	20:21416	OSTI; NTIS		DE95787842	
2064	20:20609	OSTI; NTIS		DE95787834	
2065	20:21145	OSTI; NTIS; INIS		DE95787839	
2066	20:21126	OSTI; NTIS		DE95787836	
2067	20:21143	OSTI; NTIS; INIS		DE95787835	
2068	20:21112	OSTI; NTIS; INIS		DE95787833	
NEI-NO–					
569	20:21086	OSTI; NTIS		DE95779284	
NESC–					
835	20:22946	*See* ESTSC–001047C007400			
947	20:22936	*See* ESTSC–001021U110000			
9534	20:22943	*See* ESTSC–001043CY00100			
9899	20:22944	*See* ESTSC–001044C760000			

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NESC–					
9899	20:22945	*See* ESTSC–001044CY00100			
NIFS–					
311	20:22852	OSTI; NTIS; INIS		DE95780476	
312	20:22853	OSTI; NTIS; INIS		DE95780463	
313	20:22854	OSTI; NTIS; INIS		DE95780475	
314	20:22855	OSTI; NTIS; INIS		DE95780464	
315	20:22856	OSTI; NTIS; INIS		DE95780473	
316	20:22857	OSTI; NTIS; INIS		DE95780465	
317	20:22858	OSTI; NTIS; INIS		DE95780470	
318	20:22859	OSTI; NTIS; INIS		DE95780478	
319	20:22860	OSTI; NTIS; INIS		DE95780471	
321	20:22861	OSTI; NTIS; INIS		DE95780472	
322	20:22882	OSTI; NTIS; INIS		DE95780466	
323	20:22883	OSTI; NTIS; INIS		DE95780467	
324	20:22884	OSTI; NTIS; INIS		DE95780479	
326	20:22885	OSTI; NTIS; INIS		DE95780469	
327	20:22862	OSTI; NTIS; INIS		DE95780468	
328	20:22863	OSTI; NTIS; INIS		DE95780477	
NIFS-MEMO–					
15	20:22864	OSTI; NTIS; INIS		DE95780474	
NILU-F–					
18/94	20:21666	OSTI; NTIS		DE95779280	
4/94	20:21364	OSTI; NTIS		DE95779282	
7/94	20:22210	OSTI; NTIS		DE95779277	
8/94	20:22211	OSTI; NTIS		DE95779278	
9/94	20:21365	OSTI; NTIS		DE95779281	
NILU-OR–					
11/94	20:22212	OSTI; NTIS		DE95779283	
14/94	20:22213	OSTI; NTIS		DE95779274	
17/94	20:21366	OSTI; NTIS		DE95779285	
20/94	20:22215	OSTI; NTIS		DE95787846	
21/94	20:21367	OSTI; NTIS		DE95779279	
23/94	20:22236	OSTI; NTIS		DE95779275	
25/94	20:22320	OSTI; NTIS		DE95779276	
NREL/CP–					
433-7748	20:21694	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004052	MF-1400
462-7900	20:21518	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004100	MF-1320
NREL/SP–					
420-7849	20:21080	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004054	MF-1310
440-6642	20:20600	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006896	PC-1210
441-7814	20:21151	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004090	MF-1210
NREL/TP–					
400-7830	20:21378	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004087	MF-900
411-8006	20:21119	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009217	MF-1270
413-7991	20:21114	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009222	MF-1263
413-8008	20:21115	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009229	MF-1263
425-7529	20:21538	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004092	MF-1504
425-7607	20:21107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009232	MF-1504
425-7609	20:21539	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009226	MF-1504
430-7973	20:22321	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009215	MF-1414
433-7867	20:21100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009210	MF-1310
451-8017	20:21116	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009237	MF-1263
463-5784	20:22237	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000262	MF-1250
463-7844	20:21519	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009234	MF-1320
472-7850	20:21120	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004055	MF-1250

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473-7783	20:21334	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009207	MF-1505
NUREG–					
-1430-Vol.2-Rev.1	20:21214	OSTI; NTIS; INIS; GPO		TI95013600	
0040-Vol.19-No.1	20:21210	OSTI; NTIS; GPO; INIS		TI95012203	
0540-Vol.17-No.3	20:22973	OSTI; NTIS; GPO; INIS		TI95012135	
0540-Vol.17-No.4	20:21211	OSTI; NTIS; INIS; GPO		TI95014142	
0750-Vol.41-No.2	20:21212	OSTI; NTIS; GPO; INIS		TI95011785	
0940-Vol.14-No.1-Pt.2	20:22370	OSTI; NTIS; GPO; INIS		TI95013064	
0940-Vol.14-No.1-Pt.3	20:21213	OSTI; NTIS; GPO; INIS		TI95012865	
1275-Vol.11	20:21189	OSTI; NTIS; GPO; INIS		TI95011770	
1433-Vol.2-Rev.1	20:21238	OSTI; NTIS; INIS; GPO		TI95013536	
1433-Vol.3-Rev.1	20:21180	OSTI; NTIS; INIS; GPO		TI95013539	
1434-Vol.3-Rev.1	20:21181	OSTI; NTIS; INIS; GPO		TI95013537	
1492	20:22462	OSTI; NTIS; GPO; INIS		TI95013058	
1496-Vol.1	20:21016	OSTI; NTIS; GPO; INIS		TI95013061	
1496-Vol.2	20:21017	OSTI; NTIS; GPO; INIS		TI95013062	
1500	20:21018	OSTI; NTIS; GPO; INIS		TI95013059	
1501	20:21312	OSTI; NTIS; GPO; INIS		TI95013060	
NUREG/CP–					
0140-Vol.1	20:21313	OSTI; NTIS; GPO; INIS		TI95011672	
0140-Vol.3	20:21314	OSTI; NTIS; GPO; INIS		TI95011768	
NUREG/CR–					
0200-Vol.1-Rev.4	20:21061	OSTI; NTIS; GPO; INIS		TI95012140	
0200-Vol.2-Pt.1-Rev.4	20:21062	OSTI; NTIS; GPO; INIS		TI95012011	
0200-Vol.2-Pt.2-Rev.4	20:22954	OSTI; NTIS; GPO; INIS		TI95012012	
0200-Vol.3-Rev.4	20:22955	OSTI; NTIS; GPO; INIS		TI95012139	
5591-Vol.3	20:21229	OSTI; NTIS; INIS		TI95007768	
5657	20:21758	OSTI; NTIS; GPO; INIS		TI95011771	
5944-Vol.1	20:21230	OSTI; NTIS; INIS		TI94000623	
6109	20:21315	OSTI; NTIS; GPO; INIS		TI95012121	
6112	20:22463	OSTI; NTIS; GPO; INIS		TI95011868	
6256-Vol.1	20:20808	OSTI; NTIS; GPO; INIS		TI95012393	
6275	20:21587	OSTI; NTIS; GPO; INIS		TI95012084	
6312	20:21239	OSTI; NTIS; GPO; INIS		TI95012122	
6318	20:21256	OSTI; NTIS; GPO; INIS		TI95013063	
6322	20:21759	OSTI; NTIS; GPO; INIS		TI95011867	
6331	20:21316	OSTI; NTIS; GPO; INIS		TI95013065	
ORNL–					
6734-Vol.1	20:21230	*See* NUREG/CR–5944-Vol.1			
ORNL/CDIAC–					
66	20:22505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012942	MF-403
76	20:22238	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011769	MF-402
79	20:22322	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012262	MF-402
80	20:22239	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012083	MF-402
ORNL/CON–					
401	20:21520	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011772	MF-1322
410	20:21475	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012536	MF-1320; MF-1400; MF-1500; MF-16
415	20:21429	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011625	MF-1370
ORNL/ER–					
206/V1	20:22351	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012537	MF-2070
284-D1/V1	20:21009	*See* DOE/OR–01-1326-D1/V1			
284-D1/V2	20:21010	*See* DOE/OR–01-1326-D1/V2			
284-D1/V3	20:21011	*See* DOE/OR–01-1326-D1/V3			
284-D1/V4	20:21012	*See* DOE/OR–01-1326-D1/V4			
299	20:20809	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012486	MF-2070
ORNL/ER/Sub–					
87-99053/75	20:21019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013228	MF-2070
87-99053/76/V1	20:21009	*See* DOE/OR–01-1326-D1/V1			
87-99053/76/V2	20:21010	*See* DOE/OR–01-1326-D1/V2			

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87-99053/76/V3	20:21011	*See* DOE/OR–01-1326-D1/V3			
87-99053/76/V4	20:21012	*See* DOE/OR–01-1326-D1/V4			
ORNL/M–					
4087	20:21396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008966	MF-2000
ORNL/NUREG/CSD–					
2/R4-Vol.1	20:21061	*See* NUREG/CR–0200-Vol.1-Rev.4			
2/R4-Vol.2-Pt.1	20:21062	*See* NUREG/CR–0200-Vol.2-Pt.1-Rev.4			
2/R4-Vol.2-Pt.2	20:22954	*See* NUREG/CR–0200-Vol.2-Pt.2-Rev.4			
2/R4-Vol.3	20:22955	*See* NUREG/CR–0200-Vol.3-Rev.4			
ORNL/PATS–					
95-001	20:20740	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009138	MF-600
ORNL/SUB–					
85-55901/05	20:21627	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012164	MF-113
87-00184/05	20:21667	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012163	MF-113
ORNL/TM–					
11568-Vol.3	20:21229	*See* NUREG/CR–5591-Vol.3			
12105	20:20810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011626	MF-2020
12294/V.1	20:21760	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010421	MF-812
12294/V.2	20:21761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010426	MF-812; MF-820
12294/V.3	20:21762	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010428	MF-812; MF-820
12294/V.4	20:21763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010427	MF-812; MF-820
12816	20:21764	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012544	
12903	20:20811	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011627	MF-2020; MF-2010
12925/R1	20:21216	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012545	MF-704
12926	20:20812	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008962	MF-2000
12937	20:21256	*See* NUREG/CR–6318			
12976	20:22361	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010432	MF-408
12985	20:21020	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012541	MF-2070
PATENTS-US–					
8000309	20:22101	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95009952	MF-700
A8002352	20:21064	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95009954	MF-701
PNL–					
10255	20:20814	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010687	MF-2030
10256	20:20815	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012229	MF-2030
10282	20:20816	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012230	MF-2030
10397	20:21021	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010422	MF-2000
10416	20:21129	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010423	MF-920
10421	20:22119	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011671	MF-900
10500-Pt.1	20:22464	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012231	MF-408
10506	20:21505	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010720	MF-906
10511	20:20817	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012764	MF-2030
10521	20:21316	*See* NUREG/CR–6331			
10523	20:22465	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012763	MF-630
10524	20:21022	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012395	MF-2000
10534	20:22324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012232	MF-2010
10550	20:22325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012478	MF-2000
10552	20:22326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012477	MF-2000
10561	20:21324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012233	MF-1370
10567	20:21430	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014507	MF-1322
10613	20:21193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013853	MF-520

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7722-Rev.2-Add.1	20:20813	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014291	MF-2070
9065-Vol.1	20:21476	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013852	MF-900
9224	20:22323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010721	MF-2010
9466	20:21504	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012396	MF-1371
9820-Rev.1	20:21477	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012765	MF-1600
D-410	20:21055	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012633	MF-515
SA-25926	20:21669	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011410	MF-406
PNL-D–					
375	20:21290	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012660	MF-500
PNL-SA–					
20757	20:22102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011491	MF-413; MF-406
24717	20:20660	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012394	MF-402
24937	20:20818	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011490	MF-402; MF-406
25157	20:21668	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012397	MF-904
25315	20:21628	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011494	MF-404
25493	20:21714	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010723	MF-113
25501	20:21023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010724	MF-2010
25658	20:22956	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011496	MF-411; MF-405
25720	20:22974	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011488	MF-400
25920	20:22957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011419	MF-900
25951	20:22327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011495	MF-402
26034	20:22240	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011493	MF-402
26066	20:21397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011492	MF-2080
26114	20:21431	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011418	MF-900
26120	20:21588	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011498	MF-404
POEF-SH–					
29	20:21024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010274	MF-507
PPPL–					
3108	20:22865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013483	PC-420; PC-426
PRL-TH–					
95-7	20:22567	*See* IC–95/76			
RAC–					
12	20:22313	*See* LBL–36825			
RFP–					
4826	20:21025	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011899	PC-721
4954	20:21765	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013235	MF-706
4999	20:21766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012986	MF-722
RISO-R–					
773(EN)	20:21148	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95779206	
778(EN)	20:20595	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95779213	
796(EN)	20:21629	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95779167	
799(EN)	20:21149	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95787780	
816(EN)	20:22241	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95787744	
818(EN)	20:21715	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE95787743	
SAIC–					
94-002	20:20819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012991	MF-810
94-6553	20:21190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012431	MF-520
SAKL-JULK–					
A209	20:21217	OSTI; NTIS; INIS		DE95632481	
SAND–					
89-0217-Rev.5	20:22906	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010679	MF-900
89-0996-Rev.	20:22975	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010196	MF-700
92-2121	20:20820	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010335	MF-721
93-2078	20:21315	*See* NUREG/CR–6109			
94-0686	20:21026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011839	MF-2010

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94-0774	20:22127	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012115	MF-706
94-1199C	20:21506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012526	MF-706
94-1832	20:21130	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012113	MF-1303
94-1884	20:21131	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010682	MF-1302; MF-1303
94-2002C	20:22113	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007747	MF-700
94-2011	20:20821	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010777	MF-814
94-2032	20:20822	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011830	MF-630
94-2059C	20:21132	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011604	MF-1303
94-2287C	20:21726	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009849	
94-2340	20:21521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011835	MF-2020
94-2418C	20:22328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011886	MF-722
94-2471C	20:21816	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012236	MF-700
94-2563/2	20:20823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011840	MF-2000
94-2586	20:22242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013874	MF-814
94-2604C	20:21150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011894	MF-1210
94-2686	20:21345	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013875	MF-900
94-2748C	20:21767	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013861	MF-704
94-2787C	20:22128	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011875	MF-742
94-2862C	20:22129	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011876	MF-742
94-2949	20:21317	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010578	PC-400
94-3162C	20:21695	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013865	MF-701
94-3188C	20:21027	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006308	MF-2020
94-3205C	20:21836	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011883	MF-706
94-3248	20:21670	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011010	MF-704
94-3250	20:21556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013828	MF-940
94-3266	20:21630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010333	MF-704
94-3267	20:20824	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013912	PC-2030
94-8779C	20:21671	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010756	MF-406
95-0084C	20:21837	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013834	MF-706
95-0320	20:22495	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011834	MF-907
95-0430	20:21398	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012523	MF-700
95-0447	20:22844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011577	MF-400
95-0453C	20:22122	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012225	MF-906
95-0500	20:21631	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012520	MF-404
95-0503C	20:21768	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008817	MF-705
95-0595	20:21632	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012521	MF-704
95-0671	20:21335	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010575	MF-406
95-0722	20:21769	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012997	MF-405
95-0724	20:21507	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012531	MF-906
95-0747C	20:22371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011602	MF-707
95-0750C	20:21817	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011889	MF-705
95-0753C	20:22958	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011895	MF-705
95-0775	20:22787	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012114	MF-700
95-0794C	20:21838	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012227	MF-404
95-0829C	20:21818	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011891	MF-400
95-0831C	20:22357	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011893	MF-708
95-0843	20:21770	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012530	MF-705
95-0848C	20:21672	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011606	MF-404; MF-401
95-0851C	20:21839	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011881	MF-706
95-0854C	20:22120	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011882	MF-706
95-0855C	20:21589	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011873	MF-702
95-0885	20:21590	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011833	MF-706
95-0903C	20:21209	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011890	MF-528
95-0904C	20:21121	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011892	MF-1290
95-0915C	20:21868	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011603	MF-706
95-0932C	20:21716	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011874	MF-700
95-0934C	20:21633	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011607	MF-111
95-0936C	20:21634	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011872	MF-704
95-0969C	20:21771	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011879	MF-722

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95-0979C	20:21673	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011605	MF-404; MF-401
95-0998C	20:21840	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011887	MF-704
95-1001C	20:21772	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011880	MF-722
95-1007C	20:22329	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012528	MF-703; MF-702
95-1038	20:21056	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013886	
95-1082C	20:21122	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013021	MF-1302
95-1083C	20:22959	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013022	MF-705
95-1087C	20:22103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013023	MF-705; MF-706
95-1108C	20:21841	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013033	MF-704
95-1123C	20:22372	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013018	MF-706
95-1144C	20:22121	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013554	MF-706
95-1145C	20:21641	*See* ANL/MSD/CP–83373			
95-1191C	20:21557	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013870	MF-906
95-1192C	20:21773	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013869	MF-706
95-1193C	20:21842	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013867	MF-704
95-1246	20:21028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013854	MF-607
95-2138C	20:20569	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013835	MF-108
95-8005	20:20825	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013916	MF-402
95-8216	20:21029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010746	MF-402
95-8228	20:20596	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010743	MF-102
95-8507C	20:21591	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014250	MF-704
95-8508J	20:21723	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010914	MF-411
95-8512C	20:21843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010915	MF-411
95-8517C	20:21829	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010700	MF-1409
95-8518C	20:21635	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010698	MF-411
95-8519C	20:22243	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010697	MF-406
95-8522C	20:21535	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010752	MF-1409
95-8530C	20:21822	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010757	MF-404
95-8551C	20:21592	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010758	MF-1409
95-8554C	20:21593	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010916	MF-404
95-8556C	20:22244	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011408	MF-411; MF-402
95-8563C	20:21524	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010761	MF-1409
95-8587C	20:22130	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011409	MF-1409
SBI-MEDD–					
108	20:21478	OSTI; NTIS		DE95787729	
SBI-R–					
242	20:21479	OSTI; NTIS		DE95787774	
SC-MAG–					
455	20:21982	*See* LBL–35419			
459	20:21983	*See* LBL–35423			
461	20:21984	*See* LBL–35425			
480	20:21986	*See* LBL–36306			
SCL–					
592	20:21991	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011147	MF-414
SFIM-AEC-ET-CR–					
95013	20:22330	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012998	
95014	20:22352	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011642	
SH-IR–					
1995-50	20:21090	OSTI; NTIS		DE95779211	
SKI-R–					
95-6	20:20826	OSTI; NTIS; INIS		DE95630821	
SL–					
92-21	20:20781	*See* DOE/OR/21921–T2			
SLAC–					
95-6788	20:22059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014652	MF-414
SLAC-PUB–					
95-6787	20:21992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014651	MF-414
95-6789	20:21993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014653	MF-414
95-6790	20:21994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014654	MF-414
95-6792	20:21914	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014656	MF-414
95-6795	20:22064	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014657	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SLAC-PUB–					
95-6797	20:22065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014647	MF-414
95-6804	20:21915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014649	MF-414
95-6813	20:21995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014503	MF-414
95-6826	20:21996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013422	MF-414
95-6842	20:21997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014504	MF-414
95-6848	20:21998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014505	MF-414
95-6849	20:21870	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013279	MF-414
95-6850	20:21916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013280	MF-414
95-6881	20:21917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010742	MF-414
95-6885	20:21844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010744	MF-414
95-6886	20:22066	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012559	MF-414
95-6887	20:22067	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012560	MF-414
95-6888	20:21918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012561	MF-414
95-6890	20:22104	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012562	MF-414
95-6891	20:21999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012563	MF-414
95-6892	20:22000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012407	MF-414
95-6905	20:21919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013282	MF-414
95-6909	20:22001	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013286	MF-414
95-6910	20:22002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013287	MF-414
SLU-VNL-R–					
194	20:22331	OSTI; NTIS		DE95779296	
SR/OIAF–					
95-01	20:21218	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE95011130	MF-950
SRI-ENV–					
94-287-7960	20:21166	*See* DOE/PC/93254–T1			
SSC–					
106	20:22003	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011173	MF-414
124	20:22004	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011174	MF-414
155	20:21920	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011175	MF-414
246	20:21872	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011176	MF-414
250-Rev.	20:22537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011177	MF-414
53-App.1	20:21871	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011213	MF-414
SSC-SR–					
1012	20:21882	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011076	MF-414
1014	20:21935	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011077	MF-414
1015	20:21883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011078	MF-414
1016	20:21884	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011079	MF-414
1017	20:21854	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011080	MF-414
1022	20:21885	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011084	MF-414
1032	20:22051	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011093	MF-414
1033	20:21886	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011094	MF-414
1034	20:22052	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011095	MF-414
1237	20:21887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011171	MF-414
SSCL–					
260	20:21921	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011178	MF-414
261	20:22005	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011179	MF-404; MF-414
271	20:22006	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011225	MF-405; MF-414
274	20:22007	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011180	MF-414
332	20:22008	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011229	MF-414
388	20:22009	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011140	MF-414
412	20:22538	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011141	MF-414; MF-405
453	20:22010	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011142	MF-414
469	20:22531	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011143	MF-410
485	20:22960	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011144	MF-414; MF-405
495	20:22539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011181	MF-414
508	20:21922	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011145	MF-414
539	20:22532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011146	MF-414
622	20:21873	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011148	MF-414; MF-403
627	20:22011	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011149	MF-405
641	20:21923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011184	MF-414
650	20:21924	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011252	MF-414; MF-405
655	20:22012	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011185	MF-414; MF-405
656	20:22013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011186	MF-414
657	20:22014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011253	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
658	20:22015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011254	MF-414
669	20:22016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011187	MF-414
670	20:22017	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011188	MF-414
SSCL-Preprint–					
107	20:22020	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011117	MF-414
116	20:22663	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011212	MF-414
121	20:22021	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011050	MF-414
13	20:22577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011255	MF-414
133	20:22022	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011101	MF-414
14	20:21925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011256	MF-414
148	20:21875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011102	MF-414
160	20:22644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011103	MF-414
162	20:22023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011104	MF-414
167	20:22664	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011105	MF-414
168	20:21876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011106	MF-414
182	20:21926	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011109	MF-414
188	20:21927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011110	MF-414; MF-405
195-Rev.A	20:22024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011112	MF-414; MF-405
21	20:22558	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011257	MF-414
239	20:21928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011113	MF-414; MF-405
250	20:22025	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011114	MF-414
256	20:22105	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011115	MF-414
265	20:22026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011116	MF-414
267	20:22027	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011197	MF-414
269	20:22028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011118	MF-414
291	20:22029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011121	MF-414
298	20:22030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011119	MF-414
31	20:22018	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011039	MF-414
313	20:22031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011120	MF-414
332	20:21929	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011122	MF-414
37	20:22019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011040	MF-414
38	20:21874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011046	MF-414
420	20:22032	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011123	MF-400
422	20:22033	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011124	MF-414
431	20:22034	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011125	MF-414
434	20:22035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011126	MF-414
450	20:22036	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011128	MF-414
455	20:22037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011132	MF-414
458	20:22038	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011133	MF-414
471	20:22039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011135	MF-414; MF-405
479	20:22040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011199	MF-414; MF-405
480	20:22645	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011136	MF-414
494	20:22041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011137	MF-404
500	20:22042	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011200	MF-414
506-93	20:22559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011205	MF-414
508	20:22043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011222	MF-414
521	20:22044	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011216	MF-414
522	20:22045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011215	MF-414
525	20:22046	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011138	MF-414
526	20:22560	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011139	MF-414
534	20:22578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011028	MF-414
539	20:21930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011029	MF-414
543	20:21931	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011153	MF-414; MF-405
544	20:22665	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011030	MF-414
547	20:22962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011032	MF-414; MF-405
551	20:22047	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011154	MF-414
554	20:22533	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011157	MF-414
557	20:22048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011036	MF-414
559	20:21877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011038	MF-407; MF-414
560	20:22049	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011158	MF-414
561-Rev.1	20:21932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011159	MF-414
568	20:22050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011162	MF-414
61	20:22961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011049	MF-414; MF-405

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SSCL-SR–					
1038	20:21933	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011791	MF-414
1210	20:21878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011163	MF-414
1220	20:21879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011165	MF-407; MF-414
1227	20:21934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011167	MF-406; MF-414
1230	20:21880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011168	MF-414
1232	20:21881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011170	MF-414
STUK-YTO-TR–					
47	20:21823	OSTI; NTIS; INIS		DE95632432	
STUK/ST-GUIDE–					
12.3	20:22466	OSTI; NTIS; INIS		DE95631118	
STUK/YVL-GUIDE–					
6.3	20:21231	OSTI; NTIS; INIS		DE95631351	
6.7	20:21232	OSTI; NTIS; INIS		DE95631352	
SU-ITP–					
92/14	20:22663	*See* SSCL-Preprint–116			
93-22	20:22559	*See* SSCL-Preprint–506-93			
TKK-KO/AT–					
1994/1	20:21487	OSTI; NTIS		DE95779246	
TKK-S/SLV–					
15	20:21323	OSTI; NTIS		DE95779248	
TKK-V–					
B82	20:21594	OSTI; NTIS		DE95779270	
B94	20:21595	OSTI; NTIS		DE95779247	
UBA-FB–					
93-066	20:22492	OSTI; NTIS (US Sales Only)		DE95785973	
UCB-PTH–					
95/05	20:22555	*See* LBL–36819			
UCRL–					
52000-95-1/2	20:21399	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012112	PC-700
UCRL-CR–					
112910-2	20:21845	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011515	MF-700
117769	20:21318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010685	MF-600
119477	20:22332	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012476	MF-902
120302-Pt.1	20:22886	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013270	MF-900
120647	20:22467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013271	
120949	20:22145	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013381	MF-702
UCRL-ID–					
109089-93	20:21846	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012473	MF-700
116044	20:22374	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013288	MF-908
116187-95-2	20:20827	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013424	MF-902
116187-95-3	20:20828	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012590	MF-902
116210-Pt.2	20:20829	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010919	MF-902
116849	20:21596	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012103	MF-900
118353	20:22131	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014456	MF-706
118538	20:21551	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015380	MF-700
118619-Rev.1	20:21400	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009559	MF-905
118660	20:20830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011522	MF-804; MF-814
118699	20:20831	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011433	MF-814
118761	20:21847	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012104	MF-900
118766	20:21758	*See* NUREG/CR–5657			
119013	20:22148	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012105	MF-712
119033	20:20832	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011434	MF-800
119073	20:22396	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011514	MF-900
119101	20:20982	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011432	MF-814
119127	20:22245	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013261	MF-403
119181	20:22766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012258	MF-700
119197	20:22123	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011700	MF-906
119298	20:20833	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012106	MF-706
119305	20:22898	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012107	MF-900
119315	20:21696	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012108	MF-900
119330	20:22150	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95012109	MF-700
119334	20:21774	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013289	MF-706
119335	20:21597	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013290	MF-900
119659	20:22333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011523	MF-903
119672	20:22132	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011524	MF-904
119697	20:21759	*See* NUREG/CR–6322			
119709	20:22246	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011442	MF-402

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
119854	20:22767	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011696	MF-910
119916	20:22887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013291	MF-712
119964	20:21598	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011532	MF-704
119970	20:21057	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011527	MF-721
120004	20:22866	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012110	MF-900
120019	20:21697	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013292	MF-700
120116	20:22867	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013294	MF-405
120133	20:20834	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013295	MF-900
120477	20:22138	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011426	MF-702
120478	20:22139	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011512	MF-702
120479	20:22133	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011427	MF-702
120480	20:22140	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011422	MF-702
120567	20:22141	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012260	MF-900
120595	20:22907	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014508	MF-900
120609	20:22976	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012479	
120611	20:21599	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011809	MF-702
120612	20:21508	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011808	MF-702
120650	20:22142	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011423	MF-702
120651	20:22143	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011526	MF-702
120664	20:22106	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012481	MF-702
120666	20:22146	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013272	MF-702
120749	20:21058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011721	MF-940
120838	20:22134	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013296	MF-700
120931	20:21558	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011693	MF-900
18991-93	20:21436	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011306	MF-900
UCRL-JC-					
112929	20:22775	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011731	MF-700
115891-Rev.1	20:21775	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011428	MF-707
116418	20:20835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011437	MF-810
116442-Rev.1	20:22791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013274	MF-404; MF-411
116858	20:22114	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011735	ND-700
117059	20:21776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013426	MF-702
117143	20:21777	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011744	MF-900
117325	20:22888	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012470	MF-712
117360	20:21848	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010920	MF-712
117397	20:22889	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010923	MF-712
117424	20:22247	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011718	MF-900
117457	20:21778	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014127	MF-900
117467	20:22890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010921	MF-706
117491	20:22891	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011738	MF-900
117494	20:22248	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012223	MF-402
117697	20:22773	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014125	MF-900
117773	20:21600	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011745	MF-700
117794	20:21849	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012458	MF-700
117805	20:22135	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012475	MF-700
117980	20:21601	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010747	MF-904
117980-Rev.1	20:21779	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011519	MF-700
118241	20:21824	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012480	MF-906
118281	20:21850	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010748	MF-906
118287	20:22249	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014202	MF-700
118380	20:22868	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010922	MF-704
118707	20:22250	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011722	MF-700
118744	20:22373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012457	MF-900
118757	20:21780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011801	MF-712
118776	20:21674	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011536	MF-704
118788	20:22144	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011730	MF-900
118789	20:22768	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011763	MF-414
118794	20:22963	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011430	MF-706
118897	20:21781	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011842	MF-2060
118898	20:20836	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011965	MF-902
118906	20:20837	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009618	MF-706
118909	20:22353	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012222	MF-702
118960	20:21401	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010263	MF-900
119004	20:22892	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012224	MF-712
119032	20:22534	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011729	MF-700
119044	20:22964	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011761	MF-705
119064	20:22115	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011760	MF-904
119069	20:22136	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011443	MF-700
119106	20:20838	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011435	MF-810

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
119121	20:20839	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011441	MF-814
119134	20:22251	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012483	MF-702
119135	20:21509	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012474	MF-702
119202	20:21851	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013429	MF-700
119203	20:22137	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014455	MF-900
119205	20:22965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010749	MF-905
119217	20:21636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013454	MF-404
119283	20:22869	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009847	MF-400
119287	20:22117	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011742	MF-900
119291	20:22107	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011733	MF-900
119293	20:22108	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011734	MF-900
119377	20:22468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011747	MF-712
119390	20:22893	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012471	MF-712
119412	20:21675	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011737	MF-900
119435	20:22334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011743	MF-900
119533	20:22894	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011802	MF-712
119591	20:21030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011741	MF-600
119724	20:20840	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011440	MF-814
119789	20:22375	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010918	MF-905
119798	20:20983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011438	MF-707
119826	20:22870	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011725	MF-905
119862	20:21702	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011740	MF-900
119874	20:20841	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011720	MF-900
119948	20:22769	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011750	MF-712
119951	20:21602	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011429	MF-700
120006	20:21852	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011746	MF-900
120053	20:20842	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011692	MF-721
120151	20:21531	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013438	MF-406
120178	20:22469	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011749	MF-712
120215	20:22493	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011748	MF-712
120255	20:21603	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011535	MF-404
120324	20:21560	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014453	MF-904
120410	20:21783	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013322	MF-701
120472	20:22496	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012221	
120490	20:22966	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011004	MF-705
120505	20:21825	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011444	MF-706
120508	20:21784	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011446	MF-706
120517	20:22895	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011517	MF-700
120534	20:22116	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011759	MF-706
120557	20:22535	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012456	MF-900
120583	20:21785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011436	MF-704
120716	20:22967	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014126	MF-900
120812	20:22362	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013266	MF-408
120938	20:21724	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013440	MF-701
120952	20:22506	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013309	MF-702
121089	20:22871	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013790	MF-706
UCRL-LR–					
105821-94-3	20:22896	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011970	PC-712
105821-94-4	20:22897	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011969	PC-712
114070-8	20:21552	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012256	PC-700
118510	20:22536	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012454	MF-700
119304	20:22968	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011699	MF-905
120452	20:22969	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013229	MF-705
USGS-OFR–					
94-342	20:20843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011866	MF-814
94-456	20:20844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011552	MF-814
94-553	20:21135	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013084	MF-403
94-569	20:22252	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013087	MF-403
UTRC-R–					
94-970566-3	20:21456	*See* DOE/CE/23810–51C			
UTSI–					
95-03	20:21444	*See* DOE/ET/10815–230			
VAEC-B–					
025	20:22109	OSTI; NTIS (US Sales Only); INIS		DE95632449	
VAEC-C–					
024	20:22470	OSTI; NTIS (US Sales Only); INIS		DE95632331	
VAEC-E–					
026	20:22110	OSTI; NTIS (US Sales Only); INIS		DE95632450	
VTT-PUB–					
203	20:20570	OSTI; NTIS		DE95779233	
208	20:22354	OSTI; NTIS; INIS		DE95779234	

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219	20:21510	OSTI; NTIS		DE95779235	
221	20:21676	OSTI; NTIS		DE95779236	
WAPD-T–					
3064	20:21819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95003873	MF-506
WHC-EP–					
0466-2	20:20984	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008793	MF-2070
0474-16	20:20845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012969	MF-2030
0536-2	20:20985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010579	MF-2010
0600-Rev.1	20:21031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012985	MF-2030
0827-Rev.1	20:20846	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010576	MF-2020
0828	20:20847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012840	MF-2020
0828-Rev.1	20:20848	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012791	MF-2020
0856	20:20849	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013573	MF-2030
0863	20:20850	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013580	MF-2000
WHC-SA–					
2616	20:20851	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008787	MF-2030
2643	20:20852	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007781	MF-2020
2746	20:21032	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008788	MF-2050
2761	20:20853	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012573	MF-2050
2768	20:20854	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013574	MF-2020
2777	20:20855	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012839	MF-2000
2792	20:21033	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008789	MF-2000
2841	20:21034	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011572	MF-630; MF-603
2855	20:21720	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011570	MF-2030
2865	20:20856	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013576	MF-2020
WHC-SD-534-CSWD–					
005-Rev.2	20:20857	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013342	MF-2020
WHC-SD-CP-OCD–					
040-Rev.1	20:20858	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010701	MF-2050
WHC-SD-CP-QAPP–					
017	20:20859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008870	MF-2070
WHC-SD-CP-SA–					
026-Rev.1	20:21035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012487	MF-2070
WHC-SD-CP-TC–					
033	20:20737	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013350	MF-2000
WHC-SD-CP-TI–					
171	20:21786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011573	MF-2050
WHC-SD-EN-CSUD–					
002	20:20986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011652	MF-2000
WHC-SD-ER5480-ER–					
001	20:21036	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010870	MF-900
001-Rev.1	20:22355	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012799	MF-2000
WHC-SD-FF-ANAL–					
003	20:21291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010737	MF-502

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WHC-SD-FL-MAR–					
001	20:20860	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013900	MF-2050
002	20:20861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013882	MF-2050
WHC-SD-GN-SWD–					
30002-Rev.1	20:22253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012583	MF-502
WHC-SD-GN-TI–					
20004	20:20987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010677	MF-2010
WHC-SD-LL-ATP–					
023	20:21853	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010739	MF-2000
WHC-SD-MP-SWD–					
30001-Rev.7	20:22770	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011546	MF-2000
WHC-SD-NR-ISB–					
001	20:20862	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013349	MF-2050
WHC-SD-SNF-ATR–					
004	20:20863	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013345	MF-2070
WHC-SD-SNF-DP–					
001	20:20741	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013329	MF-2000
WHC-SD-SNF-TRP–					
007	20:20864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013343	MF-2070
WHC-SD-SP-MAR–					
001	20:20865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013884	MF-2050
WHC-SD-SQA-CSWD–					
20022	20:20866	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012793	MF-2030
WHC-SD-TP-RPT–					
015-Rev.1	20:21037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013330	MF-2050
020	20:21787	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010563	MF-603
WHC-SD-W026-PLN–					
007	20:20867	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012952	MF-2020
WHC-SD-W030-ATP–					
003	20:20868	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011634	MF-2030
WHC-SD-W058-TA–					
001	20:20742	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012951	MF-2030
WHC-SD-W059-DR–					
001	20:22254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011545	MF-2050
WHC-SD-W105-SWD–					
1-Rev.1	20:20869	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013905	MF-2000
WHC-SD-W164-ATP–					
001	20:21038	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010941	MF-2000
WHC-SD-W236A-EL–					
002	20:20870	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010764	MF-900
WHC-SD-W236A-ER–					
013	20:20871	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008864	MF-2030
018-Rev.1	20:20872	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010939	MF-2030
021-Rev.1	20:20873	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011544	MF-2030
022	20:20874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012792	MF-2020
WHC-SD-W236A-ES–					
015	20:20875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011676	MF-2020

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WHC-SD-W236A-TI–					
020	20:20876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013338	MF-2030
WHC-SD-W236A-TS–					
001	20:20877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006597	MF-2030
WHC-SD-W320-DA–					
007	20:20878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010573	MF-2020
WHC-SD-W320-SUP–					
002	20:21039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014421	MF-2030
WHC-SD-W378-DRD–					
001	20:20879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010676	MF-2020
WHC-SD-W430-FDC–					
001	20:20880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012794	MF-2030
WHC-SD-WM-ATP–					
077-Rev.3	20:20881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012826	MF-906
125	20:21040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010574	MF-2030
128	20:20882	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013362	MF-2030
WHC-SD-WM-ATR–					
090	20:20883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013364	MF-2030
129	20:20884	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013328	MF-2070
130	20:20885	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013327	MF-2070
WHC-SD-WM-DP–					
104	20:20886	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011448	MF-2070
108	20:20887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012834	MF-2070
109	20:20888	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012837	MF-2070
110	20:20889	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012833	MF-2070
112	20:20890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013365	MF-2070
113	20:20891	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013346	MF-2070
130	20:20892	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010945	MF-2000
WHC-SD-WM-DQO–					
002-Rev.1	20:20893	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012797	MF-2030
006-Rev.1	20:20894	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011633	MF-2030
007-Rev.1	20:20895	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012787	MF-2070
018	20:20896	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012827	MF-2070
WHC-SD-WM-ER–					
400-Vol.1	20:20897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012488	MF-2030
400-Vol.2	20:20898	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012489	MF-2030
418-Rev.1	20:20899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013567	MF-2070
419-Rev.1	20:20900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013566	MF-2070
420-Rev.1	20:20901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013595	MF-2070
421	20:20902	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012831	MF-2070
421-Rev.1	20:20903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013594	MF-2070
422-Rev.1	20:20904	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014304	MF-2070

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WHC-SD-WM-ER–					
423	20:20905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012832	MF-2070
423-Rev.1	20:20906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013569	MF-2070
424	20:20907	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012830	MF-2070
424-Rev.1	20:20908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013561	MF-2030
425-Rev.1	20:20909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013559	MF-2030
426-Rev.1	20:20910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013565	MF-2070
429-Rev.1	20:20911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013907	MF-2070
434	20:20912	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013324	MF-2020
438	20:20913	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013896	MF-2070
439	20:20914	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013897	MF-2070
440	20:20915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013572	MF-2070
441	20:20916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013571	MF-2070
442	20:20917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013597	MF-2070
443	20:20918	OSTI; INIS; NTIS; GPO Dep.	E 1.99:	DE95012136	MF-2030
444	20:20919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013230	MF-2030
445	20:20920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015155	MF-2030
446	20:20921	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013596	MF-2070
447	20:20922	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013895	MF-2070
448	20:20923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013568	MF-2070
449	20:20924	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013570	MF-2070
451	20:20925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013578	MF-2070
452	20:20926	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013577	MF-2070
459	20:20927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013562	MF-2030
460	20:20928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013903	MF-2070
461	20:20929	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013902	MF-2070
462	20:20930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013898	MF-2070
463	20:20931	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013560	MF-2030
464	20:20932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013894	MF-2070
WHC-SD-WM-ES–					
283-Vol.2	20:20933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010931	MF-2050
315	20:21041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010942	MF-2070
WHC-SD-WM-ETP–					
109	20:20934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010594	MF-2030
152	20:20935	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013363	MF-2070
WHC-SD-WM-FHA–					
010	20:21042	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011509	MF-2020

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WHC-SD-WM-FRD–					
018	20:20936	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011449	MF-2070; MF-2030
WHC-SD-WM-ISB–					
007	20:20937	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013331	MF-2000
WHC-SD-WM-MAR–					
006	20:20938	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013901	MF-2050
WHC-SD-WM-OTP–					
176	20:20939	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013563	MF-2070
WHC-SD-WM-OTR–					
171	20:20940	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010595	MF-2050
WHC-SD-WM-PAP–					
062	20:20941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011508	MF-2020
WHC-SD-WM-PLN–					
100	20:20743	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012836	MF-2030
WHC-SD-WM-RPT–					
099-Rev.2	20:20942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012587	MF-2020
WHC-SD-WM-SDD–					
056	20:20943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013339	MF-802
WHC-SD-WM-SP–					
006-Rev.1	20:20944	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012829	MF-2030
WHC-SD-WM-TI–					
690	20:20945	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012790	MF-2030
700	20:22255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012825	MF-2050
WHC-SD-WM-TP–					
325	20:20946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012835	MF-2070
339	20:20947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011505	MF-2070; MF-2030
354	20:20948	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013366	MF-2070
357	20:20949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011510	MF-2070
358	20:20950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013368	MF-2070
WHC-SD-WM-TSAP–					
003	20:20951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013361	MF-2070
004	20:20952	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013367	MF-2070
WHC-SD-WM-UM–					
030	20:20953	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012788	MF-2000
WHC-SD-WM-WP–					
299	20:20954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010926	MF-2030
WHC-SP–					
0564-36	20:21043	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008869	MF-607
0665-16	20:20988	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011571	MF-2070
0671-Rev.3	20:21044	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010571	MF-607
0856-Rev.2	20:21788	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013579	MF-2000
0969-48	20:20955	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013581	MF-2000
WRI–					
95-R023	20:20531	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015508	MF-102; MF-113

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WSRC-MS–					
94-0255	20:21045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060138	MF-2010
94-0356	20:21319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95004401	MF-706
94-0416	20:21604	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010972	MF-704
94-0575	20:21059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060147	MF-721
94-0628	20:21046	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010964	MF-706
95-0031	20:22977	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010965	MF-705
95-0033	20:21605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060152	MF-706
95-0038	20:20956	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010967	MF-2020
95-0064	20:20957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010960	MF-2020
95-0116	20:21789	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060132	MF-706
95-0138	20:20958	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060141	MF-721
95-0197	20:21790	OSTI; NTIS; GPO Dep.	E 1.99:	DE95060148	MF-704
WSRC-RP–					
94-1227-Rev.2	20:20959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060151	MF-702
94-927	20:22335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060136	MF-2000
WSRC-TR–					
91-671-Rev.1	20:20989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010962	MF-702
92-355-Bk.1	20:22336	OSTI; NTIS; GPO Dep.	E 1.99:	DE95060117	MF-702; MF-703
92-355-Bk.6	20:22337	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013964	MF-702; MF-703
92-427-Rev.3	20:20960	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014725	MF-721
93-451-Rev.2	20:20961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014722	MF-721
93-508	20:20962	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014724	MF-702
94-0402	20:21791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060133	MF-2020
94-0410	20:20963	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010961	MF-721
94-0478	20:20964	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060143	MF-702
94-0487-Vol.1	20:22338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060128	MF-702; MF-703
94-0488	20:22339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060129	MF-702; MF-703
94-0492	20:20990	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010976	MF-702
94-0545	20:20991	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060130	MF-721
94-0606	20:21792	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060144	MF-715
94-0608-Ref.	20:20965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013475	MF-702
94-0616	20:22256	OSTI; NTIS; GPO Dep.	E 1.99:	DE95060134	MF-2070
94-100-12	20:20733	OSTI; NTIS; GPO Dep.	E 1.99:	DE95060145	ND-2000
95-0025	20:20966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010975	MF-702
95-0029	20:20967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060135	MF-702; MF-706
95-0118	20:22340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060137	MF-702
95-0157	20:21793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060139	MF-2060
95-0160	20:20968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060140	MF-721
95-0176	20:20969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060149	MF-2000
95-0178	20:20970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95060142	MF-2030
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VC Saint Vincent and the Grenadines
VE Venezuela
VN Viet Nam
VU Vanuatu

WS Samoa

YE Yemen, Republic of
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

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ED EANDC [European American Nuclear Data Committee]
EP European Patent Office
IO ILO [International Labor Organization]
IX IUPAC [International Union of Pure and Applied Chemistry]
QS INSPEC [Information Service in Physics, Electrotechnology and Control]
QZ INPADOC [International Patent Document Centre]
WO WIPO [World Intellectual Property Organization]
XA IAEA [International Atomic Energy Agency]
XC CERN [European Organization for Nuclear Research]
XD OECD [Organization for Economic Co-Operation and Development]
XE CEC [Commission of the European Communities]
XF FAO [Food and Agricultural Organization of the United Nations]
XH AAEA [Arab Atomic Energy Agency]
XI IIASA [International Institute for Applied Systems Analysis]
XJ JINR [Joint Institute for Nuclear Research]
XK WMO [World Meteorological Organization]
XN NEA [Nuclear Energy Agency of the OECD]
XO OAU [Organization of the African Unity]
XR ICRP [International Commission on Radiological Protection]
XS ISO [International Organization for Standardization]
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